2PN cell donation in Germany. Or: How the German Embryo Protection (Act) undermines itself

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Abstract
In contrast to embryo donation, the permissibility of 2PN cell donation is highly controversial in Germany. This article is based on there being a legal loophole with respect to 2PN cell donation, which results from an inconsistency within the Embryo Protection Act on the normative status of 2PN cells. Following that thesis, the article argues that, on the basis of the normative criterion totipotency (i.e. the capacity to develop into a born human being), 2PN cells should also be considered human embryos within the meaning of the Act and thereby be protected by that Act in the same way as embryos. However, the normative assumption that 2PN cells should already be endowed with human dignity and the right to life has absurd consequences. Moreover, the consistent continuation of the Embryo Protection Act, as well as of the underlying ethical position or argumentation (i.e. the potentiality argument), leads to the even more absurd consequence of having to place every human somatic cell under the protection of human dignity and the right to life. As totipotency or the developmental potential therefore cannot delimit entities considered worthy of protection (i.e. human embryos) from entities considered not worthy of protection (i.e. 2PN cells, gametes, hESC, hiPSC and human somatic cells), it is not a suitable normative criterion. As a paradigmatic case, 2PN cell donation demonstrates that by retaining this normative criterion the now obsolete German Embryo Protection (Act) ultimately undermines itself.

KEYWORDS
absurd extension argument, embryo donation, extended pluripotent stem cells, human embryo, potentiality argument, pronuclear stages, totipotency

1 | INTRODUCTION

In contrast to embryo donation (i.e. the donation of supernumerary embryos, viz. fertilized egg cells from the time of fusion of the nuclei), it is highly controversial whether the German Embryo Protection Act (EPA) permits 2PN cell donation (i.e. the donation of supernumerary pronuclear stages, viz. impregnated egg cells after the formation but before the fusion of the two pronuclei). Despite this legal uncertainty, cryopreserved 2PN cells have been donated in Germany since 2013. As a consequence, in 2017, penalty orders were issued in Bavaria against practitioners of reproductive medicine for offering and conducting the donation of 2PN cells. The awaited judgement(s) will set a precedent.
and possibly also make new legislation necessary, similar to 2010, when the surprising decision by the German Federal Court of Justice on the legal permissibility of preimplantation genetic diagnosis (PGD) resulted in an amendment of the EPA and restricted permission for PGD. Thus, owing to its inherent inconsistencies and loopholes, the long-obsolete EPA from 1990 causes legal uncertainty resulting in the ex post and ad hoc criminal regulation of reproductive and biomedical technology.

This paper analyses the currently pressing question, in the light of 2PN cell donation, of the normative status of 2PN cells as a paradigmatic case for the inconsistency and untenability of the German legal and underlying ethical embryo protection. For this purpose, the examination is divided into a legal and an ethical part. Contrary to the two main legal positions, the article argues in the first, legal part that there is a legal loophole with respect to 2PN cell donation (Section 2.2). This loophole is based on an inconsistency within the EPA on the normative status of 2PN cells: since the Act grounds the (descriptive) definition and (normative) protection of the human embryo on the criterion of totipotency (i.e. the capacity to develop into a born human being), 2PN cells should also be considered and protected as human embryos by the Act because they are actually totipotent (Section 2.3).

The second, ethical part analyses further the ethical basis and consequences of such a normative status being ascribed to 2PN cells. The normative assumption that 2PN cells should be endowed with human dignity and the right to life is a consistent continuation of the EPA as well as of the underlying ethical potentiality argument. However, this assumption has absurd consequences, which lead to the even more absurd consequence of having to place every somatic cell under the protection of human dignity and the right to life. This argumentation refers to two versions of the absurd extension argument, firstly with respect to pronuclear stages and ultimately gametes (Section 3.1), and secondly with respect to human embryonic stem cells (hESCs) or human induced pluripotent stem cells (hiPSCs) and, thus, ultimately, to every human somatic cell (Section 3.2). The analysis of the objections that have been and are currently being raised against these two versions shows that they cannot convince: (1) the objection of a fallacy is factually inaccurate in light of recent scientific experiments, and (2) the objection of an active potential as well as (3) the objection of a natural development do not provide a criterion for a clear distinction between human embryos and other human cells. As totipotency or the developmental potential therefore cannot delimit entities considered worthy of protection (i.e. human embryos) from entities considered not worthy of protection (i.e. 2PN cells, gametes, hESCs, hiPSCs and human somatic cells), it is not a suitable normative criterion.

2 CN Federal Court of Justice 5 StR 368/09, 6 July 2010. After a long period of legal uncertainty, the Federal Court of Justice decided, contrary to the prevailing legal opinion, that the procedure was compatible with the letter and spirit of the Act. Following the judgement, the German Bundestag passed a restricted permission of PGD in 2011.

3 These terms basically mean the same potential but refer to different (also argumentative) contexts. The biological term ‘totipotency’ is used in law, whereas the term ‘developmental potential’ is used in ethics. Thereby, ‘totipotency’ is a narrow term, which is why some entities might have a developmental potential but are undisputedly not totipotent (e.g., gametes or somatic cells). For the same reason, pluripotent hiPSC were attributed with a possible ‘transient totipotency’ (cf., e.g., Heinemann, T., Dederer, H.-G., Cantz, T. (Eds.) (2014). Entwicklungsbio logische Totipotenz in Ethik und Recht. Göttingen: V&R Unipress). I will therefore distinguish between the two terms.

4 This article refers to the translation of the EPA provided by the Robert Koch Institute. Retrieved from: https://www.rki.de/SharedDocs/Gesetzes texte/Embryonenschutz gesetz_englisch.pdf?__blob=publicationFile [Accessed 30 Nov. 2018].

5 Cf. the decision of the prosecution Munich, 124 Js 202366/13, 28 July 2014.

6 Cf., e.g., Bundesärztekammer (Ed.) (2006). (Muster-)Richtlinie zur Durchführung der assistierten Reproduktion, Deutsches Ärzteblatt, 103(20), A1392–A1403: A1400; Renziowski, J. (2004). Embryonenulssie und Dreierregel. Gynäkologische Endokrinologie 3, 172–177. https://doi.org/10.1007/s10304-004-0078-1: 174f.

7 Cf. German Ethics Council. (2016). Embryospende, Embryoadoption und elterliche Verantwortung, Berlin: 44 and 119.

2PN CELL DONATION AND THE INCONSISTENCY OF THE EMBRYO PROTECTION ACT

2.1 The German legal regulation on embryo donation

Section 1 of the EPA from 1990 refers to the ‘improper use of reproduction technology’ (4). Improper within the meaning of criminal law are particularly egg donation, embryo donation and surrogacy. Thereby, the general aim of Section 1 is to prevent a so-called ‘divided motherhood’, i.e., when the mother genetically related to the child and the mother giving birth to the child are not identical. The underlying assumption of the legislator is that such a family constellation would complicate the self-discovery of the child and thus endanger his or her (emotional) well-being.5 Therefore, with respect to embryo donation, the EPA not only refers to conducting an embryo donation but already to intending to conduct an embryo donation by punishing ‘attempts to fertilise artificially an egg cell for any purpose other than bringing about a pregnancy of the woman from whom the egg cell originated’ (Sect. 1 Para 1 No. 2 EPA). In advance, Section 1 also aims at preventing the emergence of supernumerary embryos that could be donated. For this purpose, the Act prohibits transferring more than three embryos in vitro into a woman within one treatment cycle (Sect. 1 Para 1 No. 3 EPA) and fertilizing more egg cells than may be transferred within one treatment cycle (Sect. 1 Para 1 No. 5 EPA). Strictly speaking, these prohibitions mean that a maximum of three embryos are allowed to be produced in vitro (called the ‘rule of three’). This rule of three is interpreted in a broad sense as having a maximum of three embryos in vitro available that are actually suitable for transfer (called the ‘German compromise’).5 This means that the physician can assess the loss rate and fertilize as many embryos as he or she considers are needed.

Although this broad interpretation is controversial, as it may violate Sect. 1 Para 1 No. 5 EPA in its wording and in its purpose (to prevent the emergence of supernumerary embryos),7 it has become frequent practice within in vitro fertilization (IVF). The consequence is that more supernumerary embryos (i.e. within the meaning of the law fertilized egg cells from the time of fusion of the nuclei) as well as more pronuclear stages, where the two pronuclei have formed but not yet fused in the course of fertilization (also referred to as impregnated egg cells or two pronuclei cells, 2PN cells), are emerging than originally intended by the German legislator.8 In the unwanted event of the emergence of supernumerary embryos, the legislator forewent a general...
prohibition of embryo donation. Therefore, the prohibition of embryo donation refers only to the purposeful fertilization of an egg cell for a later embryo donation and not to the donation of an embryo already produced for another purpose (i.e. for ‘bringing about a pregnancy of the woman from whom the egg cell originated’, Sect. 1 Para 1 No. 2 EPA). Thus, the donation of an already existing embryo is allowed in Germany because a donation is the only way to save the embryo from dying. The so-called ‘rescue clause’ is based on the assumed human dignity and right to life of human embryos in vitro. This implicit normative assumption can be derived from different sections within the EPA (e.g. particularly Sect. 2 Para 1 EPA, which prohibits the use of an embryo for a ‘purpose not serving its preservation’) as well as from the justification of the Act, which takes account of the value-based decisions of the constitution in favour of human dignity and life.

On this legal basis, some reproduction centres in Germany have, since 2013, been offering embryo donation and allied themselves in the ‘Network Embryo Donation’. The Network states that it aims at placing supernumerary embryos that have been released for donation at the disposal of involuntarily childless couples. The homepage does not mention that the Network also passes on 2PN cells. However, while the permissibility of (supernumerary) embryo donation is legally unambiguous, the permissibility of 2PN cell donation is highly controversial. The reason for the legal controversy is that the rescue clause explicitly refers to embryos, and an embryo within the meaning of the Act is a ‘human egg cell, fertilised and capable of developing, from the time of fusion of the nuclei’ (Sect. 8 Para 1 EPA; emphasis by the author). As 2PN cells are impregnated egg cells in which the two pronuclei have not yet fused, the rescue clause does undisputedly not apply to 2PN cells. This leads to the controversial question whether the prohibition of (an intended) embryo donation also applies to 2PN cells. That would be the case if the fertilization were aimed at a later embryo donation. This case depends on the definition of the term ‘fertilization’ within the meaning of the Act: ‘Fertilization’ can refer either to the beginning of the fertilization process (impregnation) or to the successful completion of the fertilization process (Fusion of the nuclei).

### 2.2 The legal loophole with respect to 2PN cell donation

2PN cells are produced in the course of an IVF cycle by bringing together an egg cell with sperm cells (classic IVF) or injecting one sperm cell directly into the egg cell (intracytoplasmic sperm injection, ICSI). After the formation of the two pronuclei, the supernumerary impregnated egg cells are cryopreserved for possible transfer in a future cycle. If these 2PN cells are not needed or wanted later by the genetically related couple, they may be donated to another couple. Thereby, not only the fertilization (and generation of embryos) is prohibited without the intention to bring about a pregnancy of the woman from whom the egg cell originated (Sect. 1 Para 1 No. 2 EPA), but also even the impregnation of egg cells (and the generation of 2PN cells) for any other purpose (Sect. 1 Para 2 EPA). Within an IVF cycle, at the time of the impregnation, the purpose is to (eventually) transfer the developing embryo into the uterus of the woman from whom the egg cell originated. Therefore, if ‘fertilization’ within Sect. 1 Para 1 No. 2 EPA is understood in the sense of impregnation, then, owing to the lack of intent to donate during fertilization, the prohibition of (an intended) embryo donation does not apply to 2PN cell donation. The Network Embryo Donation takes this position based on a legal opinion from 2011. However, the explicit differentiation between fertilization and impregnation within the Act speaks against the assumption that the legislator uses the two terms synonymously. If the two terms were to mean the same, then why should the same action be regulated twice in two different paragraphs (Sect. 1 Para 1 and Para 2)?

A closer look at the justification of Sect. 1 Para 2 gives a clear answer to that question: ‘The requirement amends the regulation of paragraph 1 number 2 in case that the action does not aim at a fertilization – i.e. the fusion of the nuclei – but merely at the generation of the corresponding pronuclei.’ But if ‘fertilization’ refers to the time of fusion of the nuclei, it is irrelevant for the assessment of the permissibility of 2PN cell donation that they were originally generated without the intent to donate. Because, in practice, cryopreserved 2PN cells are thawed after the genetically related couple has consented to donate and a receiving couple has been found, the further development until the fusion of the nuclei initiated by the thawing aims at donating the developing embryo. For these reasons, it is generally assumed that 2PN cell donation, more precisely thawing and developing 2PN cells further with the intent to donate, is prohibited in Germany.

However, strictly speaking, the prohibition of (an intended) embryo donation refers to the fertilization of an egg cell: ‘[...] fertilise artificially an egg cell for any purpose other than bringing about a pregnancy of the woman from whom the egg cell originated’ (Sect. 1 Para 1 No. 2 EPA). Within the meaning of the Act, 2PN cells are germ
line cells: ‘Germ line cells, for the purpose of this Act, shall be all cells that, in one cell-line, lead from the fertilised egg cell to the egg and sperm cells of the resultant human being and, further, the egg cell from the insertion of or penetration by the sperm cell until the completion of fertilisation by fusion of the nuclei’ (Sect. 8 Para 3 EPA; emphasis by the author). In contrast, egg cells (and sperm cells) are germ cells (not germ line cells) within the meaning of the Act. The fact that the Act uses different terms to refer to impregnated egg cells, or ‘pronuclear stages’ according to the justification of the Act, and egg cells shows that the legislator was aware of the differentiation of these entities. It therefore cannot be assumed that the Act refers to impregnated egg cells using the term ‘egg cells’, although these are distinct entities within the meaning of the Act. However, it can be assumed that a specific term for impregnated egg cells is missing within the Act. Considering this, it is the thesis of this article that both current German legal positions on the permissibility of 2PN cell donation (represented by the Network Embryo Donation and by the German Ethics Council) are wrong. In fact, the case of thawing and further developing (i.e. fertilizing) 2PN cells is not regulated within the EPA, which means that there is a legal loophole with respect to 2PN cell donation. Consequently, donating cryopreserved 2PN cells is currently allowed or, more precisely, not prohibited in Germany.

Owing to the legal uncertainty regarding the thawing and further development of 2PN cells with the aim of donating the developing embryos, penalty orders were issued in 2017 against four members of the Network Embryo Donation for aiding the improper use of reproduction technology (as board members of the Network) as well as for the improper use of reproduction technology itself (as practitioners of reproductive medicine). In March 2018, the Local Court Dillingen acquitted the defendants on the basis of an unavoidable mistake of law (Sect. 17 German Criminal Code) caused by the uncertainty in the interpretation of the EPA. However, the court confirmed that the thawing and further development of 2PN cells with intent to transfer the developing embryo into a woman other than the woman from whom the egg cell originated violates Sect. 1 Para 1 No. 2 EPA and is therefore punishable. It pointed out that an explicit regulation of embryo donation is currently missing in Germany and that the legislator should ensure legal clarity. On that basis, the prosecution appealed. The District Court Augsburg decided in December 2018 against the first instance and in contrast to the general legal assumption (cf. footnote 17) that the thawing and further development of 2PN cells with intent to transfer the developing embryo into a woman other than the woman from whom the egg cell originated does not violate Sect. 1 Para 1 No. 2 EPA. The decision was justified by the understanding that fertilization is already completed with the formation of the two pronuclei and that the fusion of the nuclei is therefore no longer fertilization but the natural development after completed fertilization. The judges based their understanding of the legal term ‘fertilization’ within the meaning of the Act not on the Act but on a new guideline of the German Medical Association on assisted reproduction from April 2018. Because the guideline does not define the medical term ‘fertilization’ (or ‘fertilized egg cell’), the judges pointed out that the guideline assumes that ‘the impregnated egg cell becomes a fertilized egg cell with reaching the proper 2PN stage’ based on one paragraph mentioning ‘the properly fertilized egg cells with two pronuclei’. However, this interpretation of the guideline is inconsistent with the fact that the guideline does define impregnated egg cells as ‘human egg cells from penetration or insertion of the human sperm cell until the time of fusion of the nuclei’. As the judgement contradicts the EPA not only in its wording (cf. e.g. Sect. 1 Para 1 No. 2 and Sect. 1 Para 2 together with the above mentioned justification of Sect. 1 Para 2 as well as Sect. 8 Para 1 and 3 EPA) but also in the general aim of Section 1 (to prevent ‘divided motherhood’), it was to be expected that the prosecution appealed. The future judgement(s) of the higher court(s) will set a precedent and possibly also make new legislation necessary, as was the case in 2010 after the decision of the German Federal Court of Justice on PGD. In 2010, the legal uncertainty concerned mainly the definition of the term ‘use’ within Sect. 2 Para 1 EPA; now it will concern the definition of the terms ‘fertilisation’ and ‘egg cell’ within Sect. 1 Para 1 No. 2 EPA.

2.3 The inconsistency on the normative status of 2PN cells

The identified legal loophole with respect to 2PN cell donation is based on two inconsistencies within the EPA: first, that the prohibition of (an intended) donation does not apply to 2PN cells; and second, that the rescue clause does not apply to 2PN cells. Both regulations should also apply to 2PN cells.

As mentioned above, the general aim of Section 1 within the EPA is to prevent a ‘divided motherhood’. However, the feared danger of such a family constellation is the same for 2PN cell donation as for egg donation, embryo donation or surrogacy. Therefore, on the basis of its own logic, the Act should also prohibit the (intended) donation of 2PN cells. The second inconsistency, related to the rescue clause, exists on two

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20Official translation slightly changed to express the meaning more accurately.
21Cf. German Bundestag, op. cit. note 5, p. 10.
22If at the time of the commission of the offence the offender lacks the awareness that he is acting unlawfully, he shall be deemed to have acted without guilt if the mistake was unavoidable.
23Local Court Dillingen 306 Cs 202 Js 143548/14 (2), 20 Mar 2018.
24Extracted from an anonymized copy of the judgement, which is not yet available [11 Oct 2018]. Cf. https://www.spenderkinder.de/rechtliche-zulaessigkeit-der-embryonen-pendemit-impraegnierten-eizellen-geht-in-die-naechste-instanz/#footnote_0_3101 (Accessed 30 Nov, 2018).
25German Medical Association, op. cit. note 25, A13, 3.3.2.3. Translation by the author.
26District Court Augsburg, 16 Ns 202 Js 143548/14, 13 Dec, 2018.
27Ibid.: recital 49. Translation by the author.
28Guideline on the removal and transfer of human germ cells in the course of assisted reproduction. Dtsch Arztebl 11 May, 2018. doi: 10.3238/arztebl.2018. Rili_asReproduktion_2018.
29District Court Augsburg, op. cit. note 22, recital 59. Translation by the author.
30District Court Augsburg, op. cit. note 22, recital 59. Translation by the author.
31Ibid., A3. Translation by the author.
32Anyone who disposes of, or hands over or acquires or uses for a purpose not serving its preservation, a human embryo produced outside the body, or removed from a woman before the completion of implantation in the uterus, will be punished with imprisonment up to three years or a fine. Emphasis by the author.
levels: the descriptive and the normative level – which coincide in the EPA. The rescue clause should also apply to 2PN cells because they are, indeed, human embryos within the meaning of the Act (descriptive level) and thereby should be protected by the Act in the same way as embryos (normative level). As the name indicates, the EPA protects embryos. Within the meaning of the Act ‘an embryo already means the human egg cell, fertilised and capable of developing, from the time of fusion of the nuclei, and further, each totipotent cell removed from an embryo that is assumed to be able to divide and to develop into an individual under the appropriate conditions for that’ (Sect. 8 Para 1 EPA; emphasis by the author). The last section refers to the capacity of an entity to develop into a (born) human being (totipotency), which is the decisive criterion within German legal regulation for being referred to, and simultaneously protected as, a human embryo. However, this capacity also already applies to pronuclear stages between impregnation and fusion of the nuclei; in other words, 2PN cells are totipotent. After the penetration of the sperm cell into the egg cell, the fertilization process and further dividing and developing proceed automatically and continuously, given the appropriate conditions. At the time the Act was drafted, the legislator was aware of this fact. According to the justification of the Act, for example, Sect. 1 Para 2 contains a ‘prohibition to experiment with human egg cells where the fertilization process has already proceeded significantly and where even in the pronuclear stage already the genetic program of the embryo is set’. The prohibition to generate 2PN cells ‘without intending to bring about a pregnancy in the woman from whom the egg cell originated’ (Sect. 1 Para 2 EPA), i.e., to ‘experiment’ with 2PN cells, is thereby justified by the fact that, owing to the thawing of pronuclear stages, embryos, which would be ‘exposed to dying’, can emerge at any time. But why is the life of embryos worth saving from dying while the life of 2PN cells is not even though the genetic program of the future embryo is already set and, by thawing, ‘the fertilization process is brought to a conclusion quasi by itself’? Both formulations refer to totipotency as an inherent capacity or active potential. Consequently, the EPA should, on the basis of its own criterion, also consider 2PN cells as embryos endowed with human dignity and the right to life. And, in fact, the more recent Stem Cell Act (SCA) of 2002, which regulates the import of hESC from abroad, does define 2PN cells as embryos: ‘embryo means any human totipotent cell which has the potential to divide and to develop into a human being if the necessary conditions prevail’ (Sect. 3 Para 4 SCA; emphasis by the author). The reason why the EPA, in contrast, defines and protects only developable fertilized human egg cells from the time of fusion of the nuclei as embryos and totipotent cells that have been removed from such embryos is thereby purely pragmatic: this narrow embryo definition allowed the wanted application of IVF in Germany.

An obvious conclusion to the outlined inconsistencies would be to demand that 2PN cells are considered as human embryos, and thus close the legal loophole with respect to 2PN cell donation and remove the underlying inconsistencies within the EPA. Therefore, the following section analyses the normative assumption that 2PN cells are already embryos endowed with human dignity and the right to life regarding its ethical basis and consequences.

3 | HOW THE GERMAN EMBRYO PROTECTION (ACT) UNDERMINES ITSELF

The implicit assumption that human embryos (from the time of fusion of the nuclei) are endowed with human dignity and the right to life owing to their developmental potential (totipotency), which underlies, inter alia, the rescue clause of the EPA, is based on the ethical potentiality argument (PA). According to the PA, human embryos fall under the purview of human dignity and the protection of life as they potentially possess those intrinsic properties decisive for attributing such a protection status owing to their capacity to develop into born human beings (that actually possess those intrinsic properties). Thereby, the PA classically aims at justifying a protection status for human embryos from the time of fusion of the nuclei that is as strong as that for born human beings. If the PA (as well as the EPA) is, consequently, continued and it can thus be assumed that already 2PN cells should be endowed with human dignity and the right to life owing to their developmental potential, a new form of a classic objection to the PA is being formed: the absurd extension argument. This form of argument belongs to the reductio ad absurdum as a logical method to expose the fallacy within an argument by following its implications to an absurd conclusion. The proponents of the argument are left with the choice of either accepting the (in fact absurd) conclusion as a consequence or

28Cf., e.g., also Baranzke, H. (2014). Der menschliche Embryo – Naturzweck oder Handlungszweck? In T. Heinemann, H.-G. Dederer, T. Cantz (Eds.), Entwicklungsbioethologische Totipotenz in Ethik und Recht. Göttingen: V&R Unipress, op. cit. note 3, p. 186; Huber, J. (2009). Totipotenz – überfordertes Kriterium der Schutzwürdigkeit? Münster: LIT, 45 and 150.
29German Bundestag, op. cit. note 5, p. 9. Translation and emphasis by the author.
30Cf. Ibid.
31Ibid. Translation and emphasis by the author. Based on the fact that the legislator does not consider 2PN cells worth saving (because they are not human life with the potential to develop into a human person) on the one hand while recognizing a problematic divided motherhood following from 2PN cell donation (which only makes sense if 2PN cells have the potential to develop into a human person) on the other hand, Kraemer sees an ‘asymmetry of harms and benefits’ regarding 2PN cells: Kraemer, F. (2016). Ethical problems of embryo donation: The implications of split motherhood. Unpublished paper presented at the Conference on the ethics of embryo donation, organised by the Department of Philosophy at the University of Potsdam, 7-8 April, 2016 (quoted with permission of the author).
32The term ‘inherent capacity’ refers to the judgement of the European Court of Justice, which decided in 2014 that the developmental potential of a human entity has to be inherent in order for it to be regarded as a human embryo within the meaning of the European directive on the legal protection of biotechnological inventions 98/44/EC (C-364/13, 18 Dec, 2014, recital 28). The term ‘active potential’ refers to an ethical objection to the absurd extension argument (see Section 3).
33That the EPA determines the criterion of totipotency as well as a specific time (fusion of the nuclei) in Sect. 8 Para 1 for the legal designation and protection of a human embryo is contradictory, given the fact that there are totipotent entities before this specific time (i.e. 2PN cells) – a fact that was also known by the legislator at that time. However, the unity of the legal system commands that the legal provision as a whole should be consistent (Section 1 recital 24, German Criminal Code).
34Cf., e.g., Baranzke, op. cit. note 30, p. 186.
35It is often assumed that there are two different readings of the PA, which refer either to a ‘potential person’ or to a ‘person with potential’. However, in my opinion, the so-called second version is actually a species argument (see also Stier, M. (2017). Von Missverständnissen und Absurditätsvorwürfen, oder: Wie sich das Potentialitätsargument in Luft auflöst. In M. Rothhaar, M. Hähnel, R. Kipke (Eds.) Der manipulierbare Embryo. Paderborn: Mentis). I will therefore only analyse the PA referring to ‘potential persons’.
rejecting their argument (at least in this version) and finding a way to improve it that avoids the absurd conclusion. As a counter argument to the PA, the absurd extension argument was raised in two versions by referring to different kinds of entities that had the same developmental capacity as claimed for human embryos and that should therefore be protected in the same way (i.e. as born human beings).

3.1 | The earlier version of the absurd extension argument

The first and earlier version of the absurd extension argument referred to **pronuclear stages** and consequently to gametes: if 2PN cells were to be protected morally and legally in the same way as embryos, the previous practice of disposing of no longer required 2PN cells would have to be regarded as a massive annihilation of human life. Moreover, as (normal, healthy) egg and sperm cells put together in a petri dish are able to ‘find’ each other independently, also even gametes have the potential to develop into (a born) human being and should therefore be protected in the same way. Similarly, masturbation would have to be considered as mass murder. To normatively delimit the developmental potential of a human embryo from that of other human cells and thereby avoid the absurd conclusion of having to place every human egg and sperm cell under the protection of life and dignity, the proponents of the PA improved their argument by narrowing the developmental potential. The main objection to the absurd extension argument in the earlier version was that the potential worthy of protection within the PA would have to be active, i.e., to develop ‘from within’ without further external interventions (except necessary environmental conditions) into a born human being. It is argued that, while the potential of sperm and egg cells would be only passive as they ‘cannot do anything by themselves’ and would require an additional act to instigate the generation of a new organism, the human embryo would already be an organism that requires only the opportunity to develop gradually.

First, this objection cannot argue against pronuclear stages, as the potential of an egg cell in the middle of the fertilization process is just as ‘active’ as the potential of an egg cell a few hours later at the end of the fertilization process. As mentioned, 2PN cells do develop by themselves until the fusion of the nuclei and do not require any external intervention for that process. Therefore, the objection related to an active potential cannot explain why the PA does not protect 2PN cells in the way that it protects embryos. If it is further argued that, to be attributed with an active potential, it would be necessary for the entity to already be an organism, i.e., a human being with an individual genome, an implicit normative preliminary decision has been taken on the beginning of human life, which is set at the time of fusion of the nuclei. However, this reasoning is circular because it justifies the attribution of human dignity and the right to life, i.e., here the beginning of human life, with an active potential to develop into a (born) human being, and the attribution of such an active potential again with the beginning of human life. Second, the objection indeed distinguishes (separated) gametes from human embryos: egg and sperm cells (for the sake of the argument, outside a petri dish) do in fact require an additional act to develop into a human being, but so do human embryos in vitro. Gametes already carry the potential to develop into a human being in themselves. Certainly, the developmental potential of egg and sperm cells still needs to be ‘switched on’ by an additional act (i.e. bringing them together). However, it is not clear why the transfer of human embryos in vitro into the uterus of a woman should be considered as ‘merely’ providing necessary environmental conditions while, in contrast, the bringing together of egg and sperm cells should be a normatively relevant additional act.

3.2 | The newer version of the absurd extension argument

The technological advances in the field of stem cell research entailed a newer version of the absurd extension argument, which refers to hESC or hiPSC and ultimately to every human somatic cell. An application of tetraploid complementation assay in humans would (theoretically) result in born human beings. Therefore, also already hESC or hiPSC should be endowed with human dignity and protection of life. Consequently, considering the iPSC reprogramming, the same applies to every human somatic cell. Tetraploid complementation assay is a cloning technique that was first successfully conducted in mammals using iPSC in 2009 and is applied as a pluripotency test for human and non-human stem cells. The procedure merges two cells of a (mouse)

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28Cf., e.g., Merkel, R. (2002). Forschungsobjekt Embryo. Verfassungsrechtliche und ethische Grundlagen der Forschung an menschlichen embryonalen Stammzellen. München: dtv: 174ff.
29See, e.g., Singer, P., & Dawson, K. (1998). IVF technology and the argument from potential. Philosophy and Public Affairs, 17(2), 87-104: 90.
30Quante, M. (2017). Personal identity as a principle of biomedical ethics. Basel: Springer International Publishing. 65; see also e.g. Beck, M. (2009). Mensch-Tier-Weisen. Zur ethischen Problematik von Hybriden, Chimären, Parthenoten. Paderborn: Schöningh, p. 34f.
31The pronuclear stage begins approximately 18 hours after impregnation, and the completion of the fertilization approximately 24 hours after impregnation.
32Cf. e.g., Quante, op. cit. note 40, p. 65.
33Besides, in my opinion, the question of the beginning of human life is not even a relevant question when analysing the normative status of human embryos, as the formulation of this question already implies a normative relevance of being human. However, this assumption itself is an argument (i.e. the species argument) for the attribution of a normative status and has to be analysed as such.
34Cf. Schickl, H., Braun, M., & Dabrock, P. (2017). Ways out of the patenting prohibition? American Journal of Bioethics, 17(5), 19-27. doi: 10.1111/bioe.12334 ; see also Stier, M., & Schöne-Seifert, B. (2013). The argument from potentiality in the embryo protection debate: Finally ‘depotentIALIZED’? American Journal of Bioethics, 13(5), 19-27. doi:10.1111/bioe.12334; see also Quante, M. (2017). Personal identity as a principle of biomedical ethics. Basel: Springer International Publishing. 65; see also e.g. Beck, M. (2009). Mensch-Tier-Weisen. Zur ethischen Problematik von Hybriden, Chimären, Parthenoten. Paderborn: Schöningh, p. 34f.
embryo to one cell with a double diploid set of chromosomes. The resulting tetraploid cell complex itself is restrictedly developable and can only form the trophoblast (outer layer of an embryo in the blastocyst stage from which the placenta and umbilical cord emerge). When this tetraploid cell complex is complemented by ESC or iPSC, these stem cells form the embryoblast (inner cell mass of the embryo in the blastocyst stage, from which the embryo and fetus emerge). After being transferred into the uterus of a mouse, the blastocyst develops in vivo into a viable mouse that is genetically identical to the used stem cells. Because the developing embryo and resulting mouse emerge from the ESC or iPSC, the procedure is considered the most stringent test for pluripotency and a reliable proof of the capacity of these stem cells to differentiate into all cell types and functional organs in the body (pluripotency).47 However, from the fact that, furthermore, a viable mouse emerges, it can be concluded that ESC or iPSC have the capacity to develop into a (born) being and not only to differentiate into all cell types of the body (totipotency). Therefore, also supposedly pluripotent hESC or hiPSC have to be considered totipotent. Consequently, owing to this considered valuable capacity, the PA has to protect hESC or hiPSC in the same way as it protects born human beings. Under consideration of the fact that hiPSC are reprogrammed from human somatic cells, this conclusion also applies to every human somatic cell. That version of the absurd extension argument has meanwhile become the major counter argument to the PA. There are three main objections to that version: (1) the objection of a fallacy, (2) the objection of an active potential and (3) the objection of a natural development.

(1) The first objection, which I call ‘objection of a fallacy’, underlines that the conclusion of the absurd extension argument was wrong. ESC or iPSC are not really totipotent, as they cannot form the trophoblast, which is actually formed by the tetraploid cell complex. Thus, the blastocyst would be totipotent but the used ESC or iPSC only pluripotent.48 In response to that objection, it has been argued that research has shown how, unlike mouse ESC or iPSC, primate ESC or iPSC in general and human ESC or iPSC in particular are able to differentiate into trophoblast cells either spontaneously or when induced by the addition of growth factors.49 However, the scientific indications for this reply were too vague to be able to refute the objection of a fallacy; it was argued that the respective experiments would lack any proof of totipotency because they did not show the capacity of one single stem cell to form a complete, viable organism.50 This lack of proof has recently been overturned (April 2017) with the development of a new technology that generates mammal and human ESC that are capable of forming embryonic and extraembryonic tissue by means of a molecule cocktail (called ‘extended pluripotent stem cells’).51 The researchers showed that tetraploid complementation assay using single mouse ESC could give rise to completely ESC-derived viable mice. Furthermore, they showed that single human ESC could contribute to embryonic and extraembryonic lineages in mouse blastocystcs as well as in further developed embryos. Thereby, the same results could be achieved with single mouse and human iPSC, which were reprogrammed from fibroblasts using the same molecule cocktail. These experiments directly disprove the raised objection: single ESC or iPSC can, in fact, form the trophoblast on their own and subsequently a complete, viable organism. Furthermore, in light of the fact that a similar proof of totipotency in humans would violate the prohibition on reproductive cloning, there is enough evidence to transfer this result to human ESC and iPSC.

(2) The second objection of an active potential has already been analysed above with respect to the earlier version of the absurd extension argument. The conclusion for hESC or hiPSC and human somatic cells is the same as for gametes: human somatic cells also carry all the genetic information necessary for the development into a human being in themselves. Certainly, they require additional acts to realize their potential (i.e., the reprogramming of human somatic cells and the complementation of hESC or hiPSC) but so do human embryos in vitro. Therefore, if requiring an additional act is normatively relevant, then, consequently, an active potential should only be attributed to human embryos in vivo and fetuses after the necessary transfer of embryos in vitro into the uterus of a woman. Otherwise, it is normatively irrelevant.

(3) The third objection states that human embryos would develop naturally into a human being whereas this development would need to be induced artificially with regard to hESC or hiPSC and human somatic cells.52 Apart from the fact that it would still have to be argued why the naturalness of a development should be normatively relevant, human embryos in vitro do not develop naturally. They are produced, cultured and transferred artificially. Therefore, to claim that the development had to be natural for the potential to be worthy of protecting within PA excludes not only hESC or hiPSC and human somatic cells but also the actual object of protection (i.e., embryos in vitro) of the PA.53

47Cf., e.g., Zhao et al., op. cit. note 46, p. 86.
48See, e.g., Beier, H. M. (2002). Zur Forschung an menschlichen embryonalen Stammzellen und Embryonen. Reproduktion medizin, 18(1), 25–31, p. 27.
49Cf. Denker, H.-W. (2006). Potentiality of embryonic stem cells: An ethical problem even with alternative stem cell sources. Journal of Medical Ethics, 32(11), 665–671. https://doi.org/10.1136/jme.2005.014738: 669.
50Cf. Beier, op. cit. note 48, p. 27f.
51Yang, Y., Liu, B., Xu, J., Wang, J., Wu, J., Shi, Ch., ... Deng, H. (2017). Derivation of pluripotent stem cells with in vivo embryonic and extraembryonic potency. Cell. 169(2), 243–257. doi: https://doi.org/10.1016/j.cell.2017.02.005. The ‘cocktail’ contains the molecules LIF, CHIR, DlM and MIH. Since those experiments, there have been numerous similar studies on the potential of (h)ESC and (h)iPSC; see, e.g., Yang, J., Ryan, D. J., Wang, W., Tsang, C. H. T., Lan, G., Masaki, H., ... Liu, P. (2017). Establishment of mouse expanded potential stem cells. Nature, 550, 391–397. https://doi.org/10.1038/nature24052: Wang, X., Li, T., Cui, T., Yu, D., Liu, C., Jiang, L., ... Hu, B. (2017). Human embryonic stem cells contribute to embryonic and extraembryonic lineages in mouse embryos upon inhibition of apoptosis. Cell Research, 28, 126–129. doi: 10.1038/cr.2017.138.
52Cf., e.g., Advena-Regnery, B., Laimböck, L., Röttländer, K., & Sgodda, S. (2012). Totipotenz im Spannungsfeld von Biologie, Ethik und Recht. Zeitschrift für medizinische Ethik, 3, 217–236, p. 229ff; Reich, J. (2004). Empirische Totipotenz und metaphysische Gattungsungleichheit bei der moralischen Beurteilung des vorgeburtlichen menschlichen Lebens. Zeitschrift für medizinische Ethik, 50, 115–130, p. 125ff.
53See also Schickl et al., op. cit. note 44, p. 415.
2PN cell donation raises the question of the normative status of pronuclear stages. The analysis showed that, because 2PN cells are actually totipotent, they should be legally considered as and protected in the same way as human embryos by the EPA. Correspondingly, 2PN cells do have a developmental potential (even an ‘active’ one) and should therefore be ethically protected as born human beings by the PA. However, the normative assumption that already 2PN cells should be endowed with human dignity and the right to life has absurd consequences. Moreover, this consistent continuation of the EPA and the underlying ethical PA leads to the even more absurd consequences. Another, more consistent and biologically plausible line of argument is that totipotency or developmental potential is not a suitable normative criterion because it cannot delimit entities considered worthy of protection (i.e. human embryos) from entities considered not worthy of protection (i.e. 2PN cells, gametes, hESC, hiPSC and human somatic cells). By sticking with this normative criterion, the EPA, as well as the PA, ultimately undermines itself.

The increasing legal uncertainty caused by the inherent inconsistencies and loopholes within the obsolete EPA from 1990 requires a new law on reproductive medicine and biomedicine. Thereby, a new legislation should be based on a broad definition of the term ‘human embryo’ that is purely descriptive. Such a definition would allow for a designation of 2PN cells as human embryos without thereby also automatically placing them under normative protection. Thus, totipotency, or developmental potential, would no longer have to be a normative criterion, which would avoid the outlined absurd consequences. Another, more consistent, normative criterion can thereby be, for example, people’s actual feelings of piety surrounding human embryos in analogy to human corpses or (in the context of organ donation) also human organs. In the context of reproductive medicine and 2PN cell donation, those feelings apparently exist also towards cryopreserved pronuclear stages, which are, for example, affectionately called ‘snowflakes’ by genetically related and receiving couples. Legal permission for embryo and 2PN cell donation would then be based on those feelings (together with the reproductive freedom of couples) and not on an implicitly assumed human dignity and right to life, which applies only to fertilized egg cells from the time of fusion of the nuclei but not to the very same fertilized egg cells about six hours earlier.

The current scientific experiments on the potential of (h)ESC and (hi)PSC show that the (descriptive) distinction between totipotent and pluripotent entities is becoming - or rather is made - increasingly unclear. Interestingly, the generated new stem cells are called ‘extended pluripotent stem cells’ although they meet the criteria for totipotent stem cells and while, at the same time, they are referred to as ‘stem cell lines with totipotent-like functional features’, which is considered as ‘progress toward the capture and stabilization of the totipotent state in vitro’. It is first and foremost necessary that scientists designate stem cells as usual in accordance with their potential to be able to distinguish totipotent from pluripotent cells in the first place. Thus, the new stem cells should be called induced totipotent stem cells (or similar), parallel to induced pluripotent stem cells, which are also named after their similar potential to naturally pluripotent ESC. Second, against the background of the forthcoming broad use of the new stem cells, the question arises on the normative level whether the German legislation and advocates of a respective strong ethical embryo protection will protect these stem cells as human embryos on the basis of their criterion totipotency or developmental potential. If so, German researchers will have to deal with a new access problem on a practical level. If not, the EPA and the PA will have to deal with another delimitation problem on a theoretical level.

**CONFLICT OF INTEREST**

The author declares no conflict of interest.

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54See, e.g., also Nationale Akademie der Wissenschaften Leopoldina. (2017). Ein Fortpflanzungsmedizingesetz für Deutschland. Halle: Leopoldina. Additionally, in October 2017, members of the National Academy of Sciences Leopoldina sent a letter to the representatives of the new Bundestag calling for a new reproductive medicine law. See also Gassner, U., Kersten, J., Krüger, M., Lindner, J. F., Rosenau, H., & Schroth, U. (2013). Fortpflanzungsmedizingesetz. Tübingen: Mohr Siebeck.

55See e.g. Schickl et al. op. cit. note 44.

56Cf. News Release Salk Institute. (2017, Apr 6) Salk scientists expand ability of stem cells to regrow any tissue type. Retrieved from https://www.salk.edu/news-release/salk-scientists-expand-ability-stem-cells-regrow-tissue-type/ [Accessed 30 Nov 2018].

57Baker, C. L., & Pera, M. F. (2018). Capturing totipotent stem cells. Cell Stem Cell. 22(1), 25–34. doi:10.1016/j.stem.2017.12.011.
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