**DO DIVISION PUZZLES PROVIDE A REASON TO DOUBT THAT YOUR ORGANISM WAS EVER A ZYGOTE?**

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A number of philosophers maintain that the destruction of an embryo in the first two weeks after fertilization is not morally problematic as it is metaphysically impossible for any human organism to then have existed. We contend that the typical adult human organism was once a zygote so there is no metaphysical shortcut to justify early abortion. We show that five arguments against human organisms ever having been zygotes fail. All of the arguments have to do with one variant or another of the zygote or early embryo dividing. They do not provide any reason to believe that since some adult organisms are not identical to zygotes due to earlier divisions, none could have been.

**I. Introduction**

Defenders of embryo-stem cell research and abortifacients that destroy embryos in the first week or two after fertilization have appealed to metaphysical features of such early embryos to render their destruction morally unproblematic. They have argued that the characteristics of early embryos that make twinning and other divisions possible preclude us from ever having been such creatures. So even if there is a compelling pro-life argument that would have made it wrong to have aborted any of us, since we didn’t exist in the first two weeks post-fertilization, we couldn’t then have been killed, harmed, and wronged by destructive embryo-stem cell research, RU-486, and morning-after pills that act as abortifacients. What occurs is more akin to contraception in preventing a human being from coming into existence than depriving an existing human being of more life. Therefore, the objections that pro-lifers levy against killing embryos in the first two weeks after fertilization can be defeated without having to resort to any moral heavy lifting. The metaphysics of the early embryo will do the job. Or so say a number of metaphysicians and bioethicists.

We counter that our organism was once a zygote.[[1]](#endnote-1) We are confident this is the case if one is not an identical twin, and suspect it might be true even if one is a twin.[[2]](#endnote-2) In this paper, we tackle various twinning or fission puzzles which are often understood as showing that we couldn’t ever have been very early embryos. We first argue that the zygote did not fission out of existence with the first mitotic division. Our second task is to explain how the zygote can give rise to the so-called “extra embryonic membranes” like the placenta as well as the “embryo proper” without this undermining our having been the zygote. We next argue that the possibility of twinning doesn’t reveal that the early embryo lacked sufficient integration to be an organism and so the mere possibility of twinning does not mean that we come into existence only after twinning becomes impossible. The fourth section shows that there are no transitivity­­-of-identity puzzles due to the possibility that the early embryo could have been divided into two sums each of which would be identical to distinct persons. Our fifth concern is again with the transitivity of identity. We argue that the early embryo can’t be reduced in size to either of two collections of cells, each of which could have been removed and transplanted into another womb where they grow into distinct embryos.

**II. Zygotic Division and Teleological Development**

It has been claimed, even by prominent pro-lifers like Marquis and Stone, that the moment our organism comes into existence could not have occurred until sometime after the zygote divides.[[3]](#endnote-3) We were never a zygote because a cell goes out of existence when it divides. The guiding principle is that cells are *essentially* cells. Cells are not like neonates who become larger as their cells multiply, developing into toddlers without going out of existence. As Stone writes “zygotes can’t grow up.”[[4]](#endnote-4) Zygotes, like all other cells, don’t become bigger, adding cell upon cell to their bulk. Rather, they divide and go out of existence. It surely would be arbitrary to maintain, say, when a skin cell or amoeba divides that it survives as one of the two cells rather than the other if they are qualitatively indistinguishable. And the original cell can’t be identical to both resulting cells if they are not identical to each other. Nor can a living cell become a scattered object because living entities must have their parts causally caught up in the same life, functioning as a unit. Thus, a number of philosophers have claimed that since cells can’t survive division, the human organism could never have ever been a zygote.

It might also be claimed that the zygote goes out of existence regardless of whether there are one or two or no successor cells because life processes have ceased. So, the problem is that the cell dies when it divides regardless of whether there are any good candidate continuers. Here is a description of cell division from Olson:

…profound changes take place within the cell when it divides. While the plans (the chromosomes) are being copied, the flow of chemically coded instructions to the rest of the cell is interrupted and its enzyme systems must function without renewal. The nucleus splits into two and the cell’s organelles arrange themselves symmetrically aroundan internal axis, the biological event that we might call the cell’s life loses its integrity and divides into two independent streams. It seems appropriate to call that the birth of two new organisms and the demise of the original cell.[[5]](#endnote-5)

Note that if death is the correct description of cell division regardless of the number of successor cells, then some caution is warranted about the four-dimensionalist solution**,** for what works for the fission of the inanimate may not be applicable to the living. If there are life processes interrupted by the division, then it doesn’t matter if there are one or two successors**;** a life has ended and no organism survives. No four-dimensionalist should entertain that what looks like a single amoeba is really two amoebas. The original amoeba’s life processes came to an end for reasons like those sketched by Olson above. So we must pay close attention to the biological details of twinning before we can rest assured that twinning doesn’t involve death even in a four-dimensional framework. Given their typical commitment to unrestricted composition, the four-dimensionalist would recognize entities stage sharing before and after an amoeba splits. But the temporally extended entities that shared stages before and after division wouldn’t be long living amoebas but some sort of creature that had many different amoebas as temporal parts; if these series of amoebas prove to be of interest, we could introduce a name for them.

So, the onus is on us to argue that cell division does not spell death or nonexistence for the zygote, but growth, regardless of whether there is a logical puzzle looming because of two equally good survivor candidates. It is important to note that zygotes do not divide and “scatter” like amoebas. They are programmed to give rise to a differentiated, multicellular organism. This provides us with some reason to think that the zygote does survive division, growing from one cell into a pair of cells. We can contend that the zygote is the only cell that is *contingently* a single cell. Thus, we disagree with Mills who warns that to claim we were once a zygote commits us to “saying something questionable…for if the zygote is identical with an object composed of the blastomeres, then an object may be a cell at one time and a non-cell, at another.”[[6]](#endnote-6)

One way to argue that zygotic division isn’t the death of an organism is to maintain that the zona pellucida, the cell’s outer membrane, is a part of the zygote. In other words, we could say that the zygote consists of a cell and zona pellucida.[[7]](#endnote-7) Since the zona pellucida doesn’t divide, unlike the cell within it, we can view the zygote as growing rather than fissioning out of existence. Both resulting cells are parts within the zona pellucida. The new embryo consists initially of a single cell *and* the zona pellucida, then two cells within the zona pellucida, and so on. Alas, there are cases of development with the zona pellucida removed.[[8]](#endnote-8) If these include the removal of the zona pellucida at the one-cell stage, then there will be scenarios where an appeal can’t be made to the zona pellucida to deny that the zygote fissions out of existence. Of course, the possibility of fissioning out of existence in the absence of a zona pellucida is compatible with claiming that the typical zygote with an intact zona pellucida survives the first cell division. Nevertheless, it suggests that the zona pellucida isn’t a crucial organism-making feature as the resulting development is the same in its absence. It seems a dubious strategy to claim that the zygote survives because of the presence of a membrane that is dispensable. Recourse to the presence of a non-dividing zona pellucida seems to be saving the life of the zygote by means of a clever trick that avoids a logical puzzle when what is really needed is a biological solution that provides reason to believe that the zygote undergoes growth due to the operations of the same life before and after cellular division.

Our solution is to stress that the division of the human zygote, with or without the zona pellucida, is very different from the division of the amoeba. The amoeba is preparing for two independent descendants that will not be involved in a process of communication and coordination, unlike the cells after the zygote divides. The zygote is readying itself for the growth into a two-cell entity. Earlier evidence of a telos towards growth is that the very entry point of the sperm is thought to dispose the two resulting cells to give rise respectively to the inner cell mass and the cells that produce the placenta.[[9]](#endnote-9) Every change within the zygote is preparation for multicellular development, not the production of two separate single-celled duplicates. This feature distinguishes the zygote from other cells about to divide, thus giving us reason to hold that the zygote grows larger into a two-celled organism rather than fissions out of existence leaving two descendants that don’t together compose anything. So, while Mills is right that our identity to a zygote means that the zygote changes from “a cell at one time” to a “non-cell at another,” it is less jarring and more illuminating to describe the zygote as a “one-cell embryo growing into a two-cell embryo.”

The zygote is unlike other cells in a number of ways. It doesn’t give rise to a line of independent duplicates of itself like amoebas or skin cells in a culture. We have already mentioned that there is evidence that one of the resulting cells will be disposed to produce the inner cell mass rather than the placenta. So, the zygote produces the two progenitors of the two structural halves of the embryo. Zygotes are also unlike stem cells which can produce two cells, one cell different from itself, and the other a new stem cell. Zygotes, unlike stem cells or pluripotent cells, produce differentiated multi-cell organisms. They are indeed early embryos. Thus, we can maintain that there is one cell, the zygote, that is not essentially a single-celled organism. The zygote prepares for later development, unlike other single human cells which aren’t the first stages in a multicellular organism’s development. The zygote is turning on and off genes that will build a multi-cell body, not two independent single-cell bodies. The fact that the paternally and maternally derived parts of the zygotic embryo are already involved in preparations for future embryonic developments that will consist of specialized and coordinated functions between cells and organisms makes it more reasonable to claim that such a cell grew rather than fissioned out of existence.

Therefore, the zygote survives fission without becoming identical to the left or right cell.[[10]](#endnote-10) Our approach doesn’t avoid arbitrariness by claiming the original cell becomes scattered as would be the case if we claimed the first amoeba was now a multi-celled amoeba scattered throughout the world, each cell of the aggregate uninvolved with the other. Nor do we claim the zygote is identical to both of the resulting cells and they are not identical to each other. Thus, we avoid arbitrariness, scattering, and weird logics by recognizing the initial one cell embryo has spread itself out, growing and changing as do multi-cellular organisms.

**III. Twinning, Fissioning, and Integration**

The division of the zygote is not the only reason given for doubting that our organism came into existence at fertilization. Much has been said, perhaps too much, about how the prospect of twinning should lead us to deny that we existed during roughly the first two weeks after fertilization. Let’s assume that twinning means that the pre-twinning individual goes out of existence. It is then claimed that the mere possibility of twinning during the first two weeks following fertilization reveals that none of us or our organisms could have been a zygote or an early embryo for two weeks after fertilization; ergo, none of us could have been killed by an abortifacient during that time.[[11]](#endnote-11) We and our organism (if they are not identical) are not the type of thing that divides and produces two living successors. So, we can’t be identical to a type of being (a pre-embryo) that can divide on the grounds of *Principle P: for any material object x, if x is capable of monozygotic twinning, then x is not a human being or animal or person*.[[12]](#endnote-12)

Howsepian points out that no one says “that in virtue of the particular capacity which earthworms have for being physically divided and yet having each of their pieces survive and develop to maturity, there are no actual earthworms in the world, only virtual (or pre-) earthworm**s**.”[[13]](#endnote-13) The same is true for amoebas. They existed as genuine individual organisms despite having the potential to fission. Howsepian and so many others insist that we should infer that human beings existed prior to twinning, as do the earthworms or amoebas.[[14]](#endnote-14)

However, that response may not be as effective as its advocates suspect. The amoeba and flat worm may not help that much to establish our early origins because human beings might twin by *separation* rather than *fission* like amoebas or *budding* like plant cuttings. Brogaard and Smith offer a thorough taxonomy in which they distinguish separation (the division of two halves) from *fission* (the cell duplicates its organs before dividing) and *budding* (where a small clone is produced that is akin to a plant cutting but the larger original organism remains just slightly reduced in size).[[15]](#endnote-15) We would further distinguish two types of separation – *violent rupture* and *peaceful parting.* The amoeba is designed to fission, to duplicate its organs. The pre-fissioned amoeba clearly was an integrated life controlled by the nucleus. The roundworm that is cut into two, unlike the amoeba, dies a violent and bloody death and perhaps doesn’t immediately produce living descendants as does the amoeba. Instead, the severed halves must reconstitute themselves into organisms like a plant cutting that most grow roots and change so as to nourish itself and do what the rest of the plant did for the cutting before it was severed.[[16]](#endnote-16) In any event, there is clearly a death as a unified organism is halved by force in separations that involve violent ruptures. But if an eight-cell human embryo separates, we don’t have anything clearly like the designed death and duplication of the one celled amoebas or the violent and bloody rendering of the worm or the reconstitution of the resulting worm. We just have something more akin to separating two masses that had been pushed together. Therefore, defenders of the view that twinning indicates the early embryo lacks the unity constitutive of life and thus the requisite individuality could stilldo so by distinguishing the twinning of the loosely integrated one- or two-week-old human embryo accomplished through mere separation from the types of division characteristic of the better integrated amoeba and the worm. The amoeba undergoes fission that involves the “preparatory duplication” of its nucleus in order to divide successfully.” The extreme integration and coordination of its parts requires such duplication for division to produce live descendants. The worm is so integrated that it undergoes a bloody ripping apart when divided. The skeptics of there being sufficient integration after human fertilization could point to the fact that the early human embryo separates without preparatory duplication or violent tearing because it is not as well integrated as the worm and amoeba.

Later origins might actually seem to be welcome news because if human beings began at fertilization, twinning could be tragic. Hearing that someone is carrying identical twins is not just a cause for celebration but a call for condolences. The monogzygotic twins would be produced by the original embryo fissioning out of existence. Thus, the Hallmark Company should carry a bittersweet card for the philosophically informed that offers “Congratulations on the creation of twins, Condolences on the death of their older sibling.” Therefore, a pregnant woman told by her doctor or sonogram technician that she is carrying identical twins should infer, if the medical personnel doesn’t want to directly deliver the poignant news, that she has lost a child, though gained two new ones. Mixed emotions, not unbridled joy, would be the more appropriate response.[[17]](#endnote-17) And so a “Congrapathy” card would be a thoughtful gesture. However, it is also possible that twinning is asymmetrical, more of the cells of the original embryo constituting one of the twins thus providing it with a better claim to be the original, just as a plant survives the removal of a cutting.[[18]](#endnote-18) But this “budding” option would not be available for rare cases of twinning at the one cell (zygote) stage, as one cell gives rise to a pair of one-celled twins. Nor would it apply at the two-celled stage where a two-celled organism gives rise to a pair of one-celled twins. And, of course, it doesn’t fit any larger embryos undergoing geometrically equal separations.

Smith and Brogaard claim that the ability of the early embryo to divide indicates it is a different kind of being from us. Pull the early embryo apart, you can get two living twins. Pull our readers apart and we get a dead reader, not two devoted fans or hostile critics. They suggest that integration required for a living being like us is not present until gastrulation (a process roughly 14-16 days after fertilization).[[19]](#endnote-19) Smith and Brogaard’s view of the early embryo is that it is just a heap of single cells that are loosely held together by the zona pellucida.[[20]](#endnote-20) It lacks the internal communication characteristic of an integrated organism where parts are serving the whole and typically are reciprocally dependent.

But what is there if it is not a human organism? There certainly seems to be a teleological unit. Remove a cell and others can compensate. If the cells were just stuck together and not engaged in intercellular communication. then there would be developmental redundancy. That belies the Smith-Brogaard claim that the early embryo “has no stability-restoring mechanism of its own of the sort which is required in order for the whole entity to be a single causal system.”[[21]](#endnote-21) If they weren’t communicating, each of the early totipotent cells would grow into a distinct human being.[[22]](#endnote-22) There certainly seems to be a teleological unit. Human embryos (and other mammalian embryos) develop in a regulativefashion that can compensate for injury; this is called *the principle of regulative development*.[[23]](#endnote-23) If a cell from a body of an embryo is removed, the embryo can adapt to this.[[24]](#endnote-24) So it is difficult for us to accept that the early embryo is like a school of fish or flock of birds just staying in alignment but not composing a larger entity.[[25]](#endnote-25) Flocks and schools of fish don’t develop, compact, reorganize, fold and move themselves to redistribute the arrangements of their components. Landing on a tree is not anywhere close to the process of implantation in the uterine womb. Flocks of birds and schools of fish and bags of marbles don’t produce anything analogous to amnion cavities, hypoblasts, exocoelomic cavities, chorionic villus etc. Development seems too predetermined and patterned. If flocks of birds and schools of fish merged after a while into a larger organism, then we would be initially more receptive to the idea that the cells in the first two weeks after fertilization don’t compose a multicellular embryo. Since they don’t, we see such flocks and schools as providing a dubious analogy and are instead disposed to interpret the complicated interactions of the cells in the first two weeks after fertilization as developments in an early stage of an already existing embryo.

**IV. Fissioning into the Placenta and the “Embryo Proper”**

A different obstacle confronting attempts to locate our origins at conception is that the zygote and the early embryo give rise to both the placenta and the inner cell mass. John Burgess writes “the problem, rather curiously, is that a zygote (morula, or blastocyst) simply does *too much* to be a human being.”[[26]](#endnote-26) Burgess, Ford, Harris, and Stretton have argued that the early embryo fissions out of existence due to its giving rise to both the placenta and the inner cell mass, the latter of which is sometimes tendentiously referred to as the “embryo proper.”[[27]](#endnote-27) Fission puzzles arise when there seems to be two equally good candidates for being an earlier pre-fissioned entity. The early embryo, in the first few days of its existence, can’t be identical to both the later embryo proper *and* the placenta. It would be arbitrary that the zygote survives as one of the two distinct entities emerging from it. But it is claimed that in the absence of a competitor, there would be reason to identify either the placenta or the embryo proper with the zygote.

One response is to construe the placenta as actually part of the organism, thus what occurs later is mere cellular differentiation rather than embryo fission. Condic, Lee and George offer considerations in favor of understanding the placenta to temporarily be an organ of the embryo that is later lost like baby teeth, hair or less memorable and collectible waste products.

However, from a scientific perspective, TE [trophectoderm] derived tissues are clearly a part of the *embryo,* not part of the mother or some other entity that co-exists with the embryo. Like all embryonic structures, those derived from TE are (1) generated by the embryo (2) physically continuous with the embryo (3) genetically identical to the embryo, and (4) critically required for embryonic function and survival.[[28]](#endnote-28)

Further reason to think the trophectoderm is part of the embryo is that the trophectoderm is needed for the inner cell mass, not just the placenta.[[29]](#endnote-29) Roussant writes “the trophectoderm and primitive endoderm lineages …provide the first signals that drive patterned differentiation of the pluripotent epiblast cells of the embryo.”[[30]](#endnote-30)

There is a second way to avoid a fission puzzle which can accept the assumption that the placenta is external to the embryo proper. There are reasons, pace Burgess and Stretton, to identify the embryo rather than the placenta with the zygote. First, the zygote is a living organism, the embryo is as well, the placenta is not a living unit, though it has parts that are living cells.[[31]](#endnote-31) So the growth of the placenta could be dealt with as an unproblematic case of asymmetrical fission, or budding; the original embryo persisting as the better candidate – in fact, the only candidate - because the other segment is not an organism. No one thinks when their hair or teeth fall out that such items would be transtemporally identical to their zygote if not for the organism part distinct from their hair or teeth. And this is not just because of the differing sizes of the hair and teeth and the hair/teeth complement. We also won’t find any advocates of the view that your left half or right half would be identical to the zygote, if not for the other body section. We suggest a similar view should be taken towards the placenta. There is no reason to think it is a later stage of what was once a zygote or early embryo. The zygote is an organism, and so is the embryo proper, as there is no other *organism* that is an equally good candidate. Ergo, there is no reason to think the zygote would be the placenta in the absence of the embryo proper. To drive the point home with a thought experiment, imagine an evil ingenious Ob/Gyn who annihilates an embryo proper during the production of its placenta. No one would think the earlier embryo survived as the placenta. Thus, there were never two equally good candidates to be identical to the zygote and the early embryo in the first week after fertilization.

There is a third reason to doubt that the zygote gives rise to a fission puzzle that should be resolved by positing later origins of the embryo. This response can also accept the claim that the placenta is not a part of the embryo that is abandoned like baby teeth (or the leaves of deciduous trees). This final explanation can be illuminated by the analogy to the spider and its web. The cells involved in web production are part of the spider, the web is not. So, the placenta precursor cells (trophectoderm) are part of the embryo, the placenta is not. There is no fission, merely creation of a useful tool external to oneself.

**V. The Identity of Embryo with the Possible Sum of its Parts**

Berit Brogaard claims to have on offer a new argument against our having ever been an early one-or two-old week embryo that “is in many ways stronger than the different twinning argument” discussed in section III that she and Barry Smith concocted seventeen years ago in their well-known paper “Sixteen Days.” Brogaard believes that twinning occurs through separation, two halves (A and B) of an embryo disconnect from each other. So you, if not a twin, are transtemporally identical to the sum of A and B. Yet your two halves could have been separated when you were an embryo and so Brogaard concludes that you could have been identical to a pair of twins. She charges that your being identical to twins violates the transitivity of identity. Brogaard explains:

Call the two parts of the embryo prior to gastrulation when twinning is still possible A and B. Even though twinning does not occur, there is a possible world in which A and B separate and continue as separate beings. The actual human being that exists after birth is transtemporally identical to the possible sum of A and B. But the actual sum of A and B is identical to the possible sum of A and B. The possible sum of A and B on the other hand, is identical to the possible sum of the two possible human beings. By transitivity, it follows that an actual human being is identical to two possible human beings.[[32]](#endnote-32)

She continues: “But one human being cannot be identical two possible human beings….” explaining that “for transitivity of identity reasons, the original cannot be identical to both of the resultant entities.”[[33]](#endnote-33) This unwelcome result can be avoided by denying that there exists an early embryo in the first two weeks after fertilization and insisting instead that the collection of cells susceptible to twinning is not identical to the human being that exists after birth. If none of us existed as loosely connected early embryos that could twin, none of us can be identical to a pair of twins.

We don’t see what Brogaard sees in the scenario she describes. We see weird human beings, we perhaps even see dead people, but no logically impossible human beings.[[34]](#endnote-34) There is no transitivity of identity problem in your being identical to the sum of two human beings. It is, of course, peculiar and it may be metaphysically impossible that there is a world in which you - the sum of A and B - have two human beings as your parts, but it is not a transitivity of identity problem.[[35]](#endnote-35) There is only a transitivity problem if you are identical to A and also identical to B, but they are not identical to each other. There is no transitivity of identity problem if there is a possible world where you have two human beings, A and B, as your proper parts. It is indeed metaphysically bizarre that you could be composed of two human beings but that is not an identity puzzle. It is just bad biology to assert that you could exist as two physically separated twins. That would mean you are not an organism - or, at least, are a very weird kind of organism. Moreover, the maximality principle that entities of the same kind can’t be in a part/whole relationship will be violated.[[36]](#endnote-36) But those are metaphysical/biological problems, not claims that run afoul of the logic of identity.

Perhaps Brogaard’s objection is not that the original embryonic individual is identical to A and also identical to B, while they are distinct from each other.[[37]](#endnote-37) Instead, her position might just be that no human being can be composed of two other human beings. Thus, no individual human being is identical to a sum of two individuals. Since she doesn’t mention a violation of “maximality”, it doesn’t seem that she is appealing to a general principle ruling out an entity of one kind being a part of an entity of the same kind. So maybe her point is just that two *human beings* can’t be the proper parts of another human being.

We have two replies to Brogaard’s attempt to show that one’s early embryonic existence entails a possible world where one would be identical to the sum of two people. First, we want to raise some doubts that a human being could be identical with the sum of her halves (A and B). Those would be the left and right halves (or top and bottom halves) of the early embryo that are split apart when twinning occurs. We doubt there are such parts. The short story is that such halves don’t play a causal role *qua* halves in sustaining the organism. For example, all of the cells of the left half may each individually serve a causal role in the development of the embryo**,** but we don’t need to understand them as composing a larger entity as the left half which has its own properties making a causal contribution to the organism. There seems to be no more reason to admit the halves into our ontology than there is to say we each have a Z-shaped object across our chest. There seems to be no function to such a thing. Such a gerrymandered spatial part doesn’t do anything and so doesn’t seem to be needed to be recognized to make sense of its alleged component cells making causal contributions to the goals of the organism. They don’t do so as components of Z**-**shaped organs.

The second objection is that even if we are identical to the sum of our halves, they have to be arranged in a certain manner. You won’t survive the switching of the location of your top and bottom halves. Thus, you could not be identical to the sum of your parts A and B when they are separated and consist as two spatially distant twin organisms.

Brogaard offers two responses. We find neither convincing. The first is directed at those, like us, who say separating A and B would destroy the individual that is the sum of A and B. We have insisted that embryos only exist when their parts are arranged in a certain manner. She writes that appeals to spatial arrangement fail because distance can’t distinguish embryonic entities from what are not embryos. She explains:

What counts against this proposal is that the parts of the pre-gastrular embryo destined to become the human being and the parts destined to become the placenta are not spatially separated. If we suppose the degree of spatial separation between two entities x and y determine whether x is identical to a future individual z while y is identical to a future individual v, the parts of the embryo destined to become the human being would in every case fail to be identical to the human being[[38]](#endnote-38).

But this doesn’t matter if we maintain with Condic, Lee and George that the placenta emerging from the blastomeres is a part of the embryo. The placenta is produced by the embryo like any other organ. It is genetically the same as the rest of the embryo and serves to integrate its vital processes in response to monitoring the environment within and without. It is just an organ that is lost with birth when the brain takes over many of the placenta’s integrative functions. It is not unlike many of our components that function as temporary parts of us like our baby teeth, hair, sperm etc.[[39]](#endnote-39)

Brogaard’s second objection to claiming that human individuals can be identified with the sum of their parts only in certain arrangements is that the early embryo is a mere collection, not structured and integrated, functioning as an individual unit. She explains:

The problem with this proposal is that the cells in the early embryo form a mere mass, being kept together spatially by an outer membrane. There is no causal interaction between the cells.[[40]](#endnote-40)

This view is not well founded. It suffices to point out that the embryo can grow in the absence of its outer membrane, the zona pellucida.[[41]](#endnote-41) Moreover, the cells of embryos are communicating and interacting, suppressing and triggering developments. See the discussion in III.

**VI. Identity, Transitivity, and Totipotency**

If we have understood Brogaard correctly, then her argument doesn’t pose a puzzle of transitivity. But we can concoct a puzzle in the spirit of what she perhaps intended.[[42]](#endnote-42) Let’s begin with a four-cell embryo that we will call “Adam.” We will label the four cells composing Adam “A,” “B,” “C,” and “D.” The background of the transitivity worry is that if C and D were destroyed, the four-celled Adam could have been pared down, coming to consist of just A and B; but if A and B were destroyed, then Adam could have become composed of just C and D. Now consider that either pair A and B or pair C and D could grow into the same human baby as Adam would if the latter was not pared down from four cells to two cells. So baby Adam could come about if none of cells A, B, C, and D were destroyed in one possible world (W1), or if just C + D were destroyed and A + B left remaining in another possible world (W2), or if A + B were destroyed, and C + D survived in a third possible world (W3), and so on. The pairs are just smaller versions of Adam.

The new transitivity problem is that instead of a pair of cells being destroyed, either pair could be removed and put into a new womb, and each would grow into a distinct human being. So imagine W4 where the removed sum of A and B could grow in a second womb into a baby who is distinct from the baby who grows from the other cell pair C + D. But if the embryo identical to the sum of A and B in W4 and the embryo who is identical to the sum of C and D in W4 are distinct human beings (Steve and Jeeves), then they could not both be Adam in their respective W2 and W3 settings. Thus, transitivity of identity is violated as the embryo composed of A and B is identical to Adam in W2, while the embryo composed of C and D is identical to Adam in W3, but the embryo consisting of C and D and the embryo consisting of A and B are not identical to each other in W4.

It should not be maintained that the puzzle arises only because of symmetrical division, there being two equally good two-celled candidates for being the original embryo (Adam) in W4. We can imagine Eve consisting of six cells A, B, C, D, E, and F in WI and surviving a reduction in size to where she consists of just two cells, E and F, if the other four cells, A, B, C and D, are destroyed; and we can imagine Eve surviving consisting of A, B, C and D if just E and F were destroyed in Wii. Then we imagine a third world Wiii where E and F are not destroyed but A, B, C, and D are transplanted and grow into a baby in another womb. There would not be here two equally good candidates for being Eve since it would seem to be a case of asymmetrical fission where Eve survives consisting of A, B, C and D rather than fissions out of existence because of the existence of an embryo consisting of two of her previous cells E and F. However, the transitivity puzzle still arises for in one world Wii, Eve would be an embryo composed of E and F, while in another world Wiii, Eve would not be identical to the embryo composed of E and F but would be identical to the sum of A, B, C, and D. It would seem that the transitivity of identity would be violated as any embryo composed of just E and F should be the same embryo whenever it exists, regardless of whether A, B, C, D are destroyed or removed intact as a unit.

The new transitivity puzzles involving early embryos could be avoided by denying that there are any early embryos. Philosophers could allege that the putative early embryo lacks sufficient integration to exist as a multicellular entity. It is this disunity that allows the just mentioned reductions, separations, and survivals to produce the transitivity problem. The problem vanishes if for two weeks after fertilization, there are just a collection of cells that don’t compose any multicellular entity, much as a school of fish doesn’t compose a larger living marine organism. Olson, van Inwagen, Ford, Smith and Brogaard can thus evade the transitivity-of-identity problem by denying there were early embryos to whom we could be identical and who could be split into living halves.[[43]](#endnote-43) They insist that we only come into existence after we have reached a stage at which we can’t be completely divided into two living parts, so there is no problem of the possibility of there being two entities, either of which we could be identical to in the absence of the other.

Since we, on the contrary, maintain that the human being came into existence at fertilization, the onus is on us to explain how to avoid the transitivity of identity puzzle. We offer two accounts, the first – which we prefer - could be acceptable to the three-dimensionalist and the four-dimensionalist, the second available to just the four-dimensionalist.

It seems somewhat biologically plausible to us to claim that four-cell Adam couldn’t come to be composed of just half of his earlier cells regardless of one’s favored view of composition, and persistence. It is a consequence of biological principles that readers might independently accept. The removal of C and D is as destructive to four-cell Adam as half of your body being suddenly beingdestroyed.[[44]](#endnote-44) Adam goes out of existence when so dramatically reduced in size, though a new organism is formed soon afterwards. The mistake is to believe the organism that soon comes into existence not long after the reduction is the same as the earlier one. Our point can be illustrated by considering the splitting of the frequently mentioned worm into two worms. When the worm is cut in half, the resulting movements of the two halves perhaps mislead people as there are not immediately two living organisms.[[45]](#endnote-45) Prior to division, the proper parts of an organism are not themselves organisms as none of the parts maintain themselves in the manner characteristic of an organism. The two halves after division have to reconstitute themselves from parts of organisms into integrated organisms. We suspect that the *immediate* results of worm fission are akin to plant cuttings that are not immediately transformed from plant parts into whole plants. There must be some time lag after fission as the parts of the cuttings “communicate” about the changes and reorganize themselves, in order to behave as the parts of a complete organism, thus ceasing to act as the parts of a segment of an organism. Readers are probably reluctant to claim that any time a branch is cut off from a plant that the branch immediately becomes a living but maimed plant. The plant cutting must begin to grow roots and do the other things characteristic of a self-maintaining organism.[[46]](#endnote-46)

Likewise, removing cells C and D from the other two cells is not immediately creating two new organisms. Neither the sum of C and D nor the sum of A and B instantly act as an organism as there is a time lag before the sum of the earlier parts starts to act as the integrated parts of a two- celled living organism, as opposed to each cell in the pair functioning in the manner it did when part of a four-cell organism. The unity of the two cells is instead more like that of a removed organ or limb than a living body. They are not yet metabolizing and maintaining homeostasis as a whole in a way characteristic of a self-maintaining organism. There must be a time lag before the information that is shared by the two parts results in interactions that are characteristic of the interaction of the parts that together completely compose an organism.

Thus if A and B don’t immediately compose a two-celled living entity on their own when removed from Adam, then nor can Adam survive being reduced in half and come to consist of just A and B when C and D are destroyed. Instead, a new two-celled organism came into existence sometime after the cells were removed and the component cells were internally restructured to grow as an embryo rather than make their individual contributions to a four-celled embryo.[[47]](#endnote-47) So if Adam couldn’t come to be composed of either of the two cells that respectively compose A and B and C and D at their origins as two-celled embryos, there then would not be organisms identical to Adam in one world and not in another. Hence, there is no transitivity problem.

Nevertheless, the biological facts may be otherwise than we have speculated in the last few paragraphs. Perhaps there is not substantial change when a four-celled organism is reduced to a pair of cells. Maybe we are also wrong to deny that there are two new worms immediately upon severing their immediate ancestor. Concerning the latter, it might be that only a living organism can grow new parts, as regeneration is not something mere particles that don’t form a larger organism can do. So the division of worm or embryo might immediately bring about one or two new, though maimed, organisms. They have to build the body, just as an embryo does. But the divided worm segments and the embryos are alive and in the process of growing organs, limbs etc.

Here an appeal here to four-dimensionalism is attractive to avoid the transitivity puzzles. The four-dimensionalist understands creatures to persist in virtue of temporal parts and to be distinct from other four-dimensional entities in virtue of having different temporal parts.[[48]](#endnote-48) The two post-division halves aren’t new entities, but already both existed earlier sharing their temporal parts. It isn’t the mere presence of the other half surviving division that determines whether the pair A and B or the pair C and D are persisting or new organisms. What we had thought was a single human being Adam, turns out to be two human beings sharing temporal parts. But since they don’t share all of their temporal parts after division as they did before, they are not identical.

Nor is the four-dimensionalist confronted here with a mystery of two post-division entities identical to the pre-division entity. The four-dimensionalist doesn’t have to just claim one being is the original without any differences other than in identity facts. We don’t want to just claim that it is an epistemic matter and there is an unknown identity fact that makes one of the halves the original embryo or worm. It would seem then that these identity facts could “float free” of other facts. There would be no reason why the other half could not have been the original. In other words, it would be possible for God to “roll back” time to the moment before division, and the original organism would survive as the other half. An appeal to just brute identity facts determining the persistence of the original through fission means that the world’s history could have been the exactly the same up to fission and the other half survives as the original. So while identity facts floating free are logically possible, their doing so is metaphysically quite problematic.

The four-dimensionalist will handle the multi-celled organism becoming reduced in size to a pair of cells without substantial change by just claiming thatthe temporally extended creature has **a** two-celled temporal part at that time, while moments earlier it had a four-cell temporal part. There wouldn’t be any puzzles of spatial coincidence as the organism hasn’t become reduced to the size of a pair of cells with which it becomes mysteriously co-located; rather it has a single two-cell temporal part again just as it earlier did after the first mitotic division. There is no asymmetry to be explained away about how two-celled embryos can become four-celled organisms but the four-celled embryos can’t become two-celled organisms. Just as the two-celled embryo earlier grew into a four-celled embryo, the later two-celled temporal part that followed the reduction will also grow into a four-celled embryo - the same human being that moments earlier had consisted of a two-celled temporal part.

**Conclusion**

If what we have claimed in sections II-VI have been persuasive, then there would seem to be little reason to maintain that our organism was never a zygote. If Animalists are correct and we persons are identical to our organisms, then we were once a zygote. So we think it is due time that certain twinning arguments against our existing from fertilization onwards should themselves fission out of existence. The theoretical telomeres have become so short that argumentative apoptosis is appropriate. The upshot for applied ethicists is that there is no metaphysical shortcut to justify early abortion, morning-after pills, and destructive embryonic stem cell research. Their permissibility will require controversial moral arguments, just as does the advocacy of abortion later in a pregnancy.

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1. We are indebted to David Boonin and a referee for many helpful comments.

   We are assuming an Animalist metaphysic in which human persons are identical to human animals. If we are not identical to our animal as McMahan, Shoemaker and other defenders of psychological approaches to personal identity maintain, early abortion could still be wrong because it destroyed a human creature with a value and future well-being comparable to our own. We human persons would come to share a brain and mental life with a human organism, so any value bestowing traits of our mental life would be shared by the organism. See Hershenov and Hershenov, “The Potential of Potential Arguments,” 46. [↑](#endnote-ref-1)
2. However, we won’t focus upon three-dimensional and four-dimensional accounts of co-location as a zygote. See Koch’s “Conjoined Twins and the Biological Account of Personal Identity” appeal to overlapping conjoined twins as providing evidence that earlier there were a pair of three-dimensional zygotes that completely overlapped. See also Rose Hershenov’s “Totipotency, Twinning and Ensoulment.” Curtis’s offers a four-dimensionalist version of two identical twin organisms sharing a zygotic temporal part in his “A Zygote could be a Human: A Defense of Conceptionalism Against Fission Arguments.” [↑](#endnote-ref-2)
3. Stone, “Why Potential Matters,” 819; Stone, “Why Potential Still Matters”, 291; Mills, “The Egg and I: Conception, Identity, and Abortion,” 336; Forbes, The Metaphysics of Modality 1985: 135; Marquis, “The Moral Principle Objection to Human Embryonic Stem Cell Research”; Stretton, “Critical Notice-Defending Life: A Moral and Legal Case Against Abortion Choice by Francis Beckwith," 197. [↑](#endnote-ref-3)
4. Stone, “Why Potential Still Matters,” 291. [↑](#endnote-ref-4)
5. Olson, The Human Animal, 114. Peter van Inwagen says something similar,Material Beings, 150-51. [↑](#endnote-ref-5)
6. Mills. “The Egg and I,” 336. [↑](#endnote-ref-6)
7. Alternatively, we could consider the cell to include the zona pellucida and claim the zygotic cell doesn’t divide, only one of its constituents. [↑](#endnote-ref-7)
8. Mansour et al, “Transfer of zona-Free Embryos.” [↑](#endnote-ref-8)
9. Pearson, “Your Destiny from Day One.” [↑](#endnote-ref-9)
10. It actually wouldn’t be any help to claim that the zygote did survive as one of the two cells of the two-celled embryo. The zygote would then survive again another division as the embryo became a three celled entity. That would only guarantee that there is one cell of the multicellular embryo that is identical to the zygote when what is needed is the zygote to be identical to the entire multicellular embryo. [↑](#endnote-ref-10)
11. Smith and Brogaard, “Sixteen Days.” McMahan also expresses some sympathy for the view, Ethics of Killing, 28. See also van Inwagen, Material Beings, 178-79; and Olson, The Human Animal, 91. [↑](#endnote-ref-11)
12. Adapted from Howsepian, “Four Queries Concerning the Metaphysics of Early Human Embryogenesis.”, 495. [↑](#endnote-ref-12)
13. Howsepian, “Four Queries Concerning the Metaphysics of Early Human Embryogenesis.” 498-499 ft. 53. [↑](#endnote-ref-13)
14. See Oderberg, “The Metaphysical Status of the Embryo” 269; George and Tollefsen, The Embryo, 149-50, 174-75; Kaczor, The Ethics of Abortion, 127-128; Beckwith, Defending Life, 77-81. [↑](#endnote-ref-14)
15. Brogaard and Smith, “Sixteen Days,” 52-54. [↑](#endnote-ref-15)
16. It is not obvious to us that every removed portion of a plant that *could* give rise to a new plant is already a maimed organism than not yet a living integrated whole. [↑](#endnote-ref-16)
17. Some philosophers have suggested that the frequent absence of mourning in cases of twinning and miscarriage suggests that we don’t believe that any of us were ever early embryos. See, McMahan, “Infanticide.” We suspect that a lack of awareness about how twinning occurs and a lack of familiarity leading to the formation of an attachment to the early embryo would better explain our reactions. Oderberg suggests that our reactions would be different if wombs had “transparent stomachs with magnifying windows…twinning would be mourned…our practices would change, and justifiably so” Applied Ethics: A Non-Consequentialist Approach, 19. [↑](#endnote-ref-17)
18. Tollefsen and George, The Embryo, 273, note 14. The reason they think the original embryo survives twinning as one of the twins, the other being a new creation, is because “in many instances there is an obvious unity of plan of development the zygote, on the one hand, and one (but not both) of his twins on the other. An example occurs in some twins in whom only one suffer from trisomy 21; evidently one of the twins is generated by the splitting and exhibits a unique plan of development that differs from the other twin.” 274 note 14. Still, there might be on occasion, symmetrical fission, an even number of cells equally split. [↑](#endnote-ref-18)
19. See Rose Hershenov “Conjoined Twins and the Biological Account of Personal Identity,” for problems with the claim that twinning occurs no later than 16 days. So even at gastrulation there would be cells that don’t yet compose an embryo. Oderberg, “The Metaphysical Status of the Embryo” makes a similar point. [↑](#endnote-ref-19)
20. Our earlier mention of a zona-less embryos provides reason to be skeptical of the Smith and Brogaard ‘heap’ account. [↑](#endnote-ref-20)
21. Smith and Brogaard, “Sixteen Days,” 60. [↑](#endnote-ref-21)
22. Gomez-Lobo et al “Sixteen Days? A Reply to B. Smith and B. Brogaard on the Beginning of Human Individuals.” [↑](#endnote-ref-22)
23. Alberts. Molecular Biology of the Cell, 2002, 1224-5; Carlson, Human Embryology and Developmental Biology. 49. [↑](#endnote-ref-23)
24. Alberts. Molecular Biology of the Cell, 2002, 1224-5; Carlson, Human Embryology and Developmental Biology. 49. [↑](#endnote-ref-24)
25. Some use bag of marbles analogy, Kaczor, The Ethics of Abortion 147. [↑](#endnote-ref-25)
26. Burgess: 2010, 61-70. He asserts that co-location is no help because they are different entities and thus not two of the same kind. This is quite as Locke is the source of a tradition that maintains that co-located individuals are less problematic when they are of different kinds (Locke: 1975, Ch. 27). [↑](#endnote-ref-26)
27. Burgess’s view about the placenta is shared by Stretton 2008, 797; Ford, 1998, 156; and Harris 1993, 223. [↑](#endnote-ref-27)
28. Lee, Pat, Maureen Condic and Robert George. “Ontological and Ethical Implications of Direct Nuclear Programming,” 37. [↑](#endnote-ref-28)
29. Roussant, “Stem Cells and Lineage Development in the Mammalian Blastocyst,” 111-118. [↑](#endnote-ref-29)
30. Roussant. “Stem Cells and Lineage Development in the Mammalian Blastocyst,” 111. [↑](#endnote-ref-30)
31. Tissues growing in a lab have living parts but they are not living organisms. They don’t meet the conditions sketched by Grobstein The Strategy of Life, 61, Olson, The Human Animal, 131; Smith, and Brogaard, “Sixteen Days” 49-50. [↑](#endnote-ref-31)
32. Brogaard, “Stem Cell Research and the Moral Status of the Human Embryo,” 87 [↑](#endnote-ref-32)
33. Brogaard, “The Moral Status of the Human Embryo: The Twinning Argument,” 87. [↑](#endnote-ref-33)
34. We are using “human being,” “human animal” and “human organism” interchangeably [↑](#endnote-ref-34)
35. Of course, it would be question begging to use the example of the early embryo as one human being composed of smaller human beings in virtue of the totipotency of the cells. However, on some views of fetus/mother mereology twins would be parts of the mother. See Kingma, “Nine Months,” “Were You a Part of your Mother,” “Lady Parts.” Of course, she won’t be composed of just them. We suppose someone might consider the Hensel twins to be one larger human organism composed of two organisms. See Liao, “The Organism View Defended,” for an argument that they are two partially separated organisms. McMahan offers an argument that they are a single organism in his The Ethics of Killing, 35-38. It is conceivable that there is a sense in which they are both right as there are two human beings that compose a third human being. However, if organisms are individuated by considerations of immune responses and metabolic activities, a case can be made that conjoined twins are really one organism. [↑](#endnote-ref-35)
36. See Sutton, “Against the Maximality Principle” for doubts about the maximality principle. [↑](#endnote-ref-36)
37. We were reading her claim that “the original cannot be identical to both of the resultant entities” as one would interpret the sentence that “Serena beat both of them in tennis.” We assumed that Serena beat each individual in a different match, not that she beat them as they played doubles against her. Perhaps the latter “doubles” interpretation is what Brogaard intended. [↑](#endnote-ref-37)
38. Brogaard, “The Moral Status of the Human Embryo: The Twinning Argument,” 87. [↑](#endnote-ref-38)
39. Further reason to think the trophectoderm are part of the embryo is that the trophectoderm is needed for the inner cell mass, not just the placenta. Roussant writes “the trophectoderm and primitive endoderm lineages …provide the first signals that drive patterned differentiation of the pluripotent epiblast cells of the embryo.” “Stem Cells and Lineage Development in the Mammalian Blastocyst.” 111. [↑](#endnote-ref-39)
40. Brogaard. “The Moral Status of the Human Embryo: The Twinning Argument,” 87. [↑](#endnote-ref-40)
41. Mansour et al. “Transfer of zona-Free Embryos Improves Outcome in Poor Prognosis Patients,” 1061-1064. [↑](#endnote-ref-41)
42. Singer and Kuhse, “Individuals, Humans, and Persons: The Issue of Moral Status,” 188-98, may have something like our revised puzzle in mind when they wondered whether each of the cells of a four-cell embryo could give rise to the same individual. This puzzle also many have been recognized by Jason Morris in his “Misconceptions Inherent in the Substance Ontology Approach to Assigning Moral Status” 164. [↑](#endnote-ref-42)
43. Olson, The Human Animal, 91; van Inwagen, Material Beings, 178-79; Smith and Brogaard, “Sixteen Days” 62-63, 69. [↑](#endnote-ref-43)
44. We have in mind a sudden reduction like losing your left half or top half, not losing half your weight in a months-long diet. Our point is that in the sudden amputation, the parts of the remaining half of your body would not constitute a life. [↑](#endnote-ref-44)
45. Keep in mind that the braindead can undergo movement so uncoordinated movement doesn’t indicate the life of the whole. [↑](#endnote-ref-45)
46. There may be here an analogue of the metamorphosis of the caterpillar into the butterfly described by Denton (and endorsed by van Inwagen) in that there is not a living organism for a period of time. Of course, the plant cutting is not like the pupation stage where “one type of organism is broken down into what amounts to a nutrient broth from which an utterly different type of organism emerges.” Denton, Evolution: A Theory in Crisis, 220. If readers didn’t accept our claim that zygotic fission was growth rather than death and nonexistence, and were right to do so, then we can help ourselves to van Inwagen’s description of the loss of life in the process of cellular division where “the life of a cell ends, and, though the simples had composed the cell continue to cohere, they no longer compose an organism” Material Beings, 150-51. Another example of the non-living organizing themselves into organisms would be at the origin of life. There would be a proto-cell that undergoes a little internal reorganization to become an instance of the first kind of living cell. See Kaufman, At Home in the Universe. [↑](#endnote-ref-46)
47. It is easier to understand why this isn’t recognized as the end result will be a living embryo. We must be careful not to overlook the possibility that the embryo at the paring down removal isn’t the same as the earlier embryo. [↑](#endnote-ref-47)
48. The three-dimensionalist denies that we persist in virtue of temporal parts. We supposedly are “wholly present” rather than just have a temporal part in the present. We “sweep” through time rather than “extend” across time. See Sider, Four Dimensionalism, 63-65, for some doubts about these three-dimensional locutions being informative. Our reasons for preferring the three-dimensionalist approach are due to the problems with four-dimensionalism that can be found in Olson, What Are We? A Study in Personal Ontology, 108-128.

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