An Identity Crisis in Philosophy

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Abstract

The following seems to be a truism in modern day philosophy: No agent can have had other parents (IDENTITY). IDENTITY shows up in discussions of moral luck, parenting, gene editing, and population ethics. In this paper, I challenge IDENTITY. I do so by showing that the most plausible arguments that can be made in favor of IDENTITY do not withstand critical scrutiny. The paper is divided into four sections. In the first, I document the prevalence of IDENTITY. In the second, I examine a defense of IDENTITY on the basis of genetic considerations. In the third, I examine a defense of IDENTITY that I call gamete essentialism. In the fourth, I return to genetic considerations to wrap up the paper.

Keywords: Nonidentity problem, Gamete essentialism, Parfit, Population ethics.

1. Setting Up the Dialectic

One of the most famous articulations of IDENTITY can be found in Saul Kripke's *Naming and Necessity*. In a thought experiment about Queen Elizabeth, Kripke asks: "How could a person originating from different parents, from a totally different sperm and egg, be this very woman?". He then argues:

> One can imagine, *given* the woman, that various things in her life could have changed: that she should have become a pauper; that her royal blood should have been unknown, and so on. One is given, let's say, a previous history of the world up to a certain time, and from that time it diverges considerably from the actual course. This seems to be possible. And so it's possible that even though she were born of these parents she never became queen [...] But what is harder to imagine is her being born of different parents. It seems to me that anything coming from a different origin would not be this object (Kripke 1981: 113).

Kripke's appeal to the sperm and egg that fuse during conception involves a thesis I attack in section 3 of this paper, gamete essentialism. But, for now, the point is that Kripke's intuition is shared by many and is deployed in many contexts.

For example, David DeGrazia, in a discussion of antenatal genetic screening, refers to the passage above from Kripke approvingly:

Argumenta (2025): 1—14
ISSN 2465-2334

DOI 10.14275/2465-2334/20250.kah
First published: 13 January 2025

> Kripke is suggesting that a given individual could not have come into being, in a counterfactual situation, from different parents—or even from a different sperm and egg—than those from whom she did in fact derive. I agree. You would never have come into being if the very sperm and egg from which you in fact derived had never joined in fertilization (DeGrazia 2005: 246).

Similarly, Julia Driver uses IDENTITY to argue against modal accounts of moral luck: she argues that such accounts cannot make sense of claims like "I am lucky to have had the parents I had" (Driver 2013: 166), for the identities of my parents are not modally fragile. Derek Parfit, in setting up the nonidentity problem in *Reasons and Persons*, quotes someone who speculates about "who we would have been if our parents had married other people". He then says: "In wondering who she would have been, this woman ignores the answer: 'No one'" (Parfit 1984: 311). Christine Korsgaard, in the broader context of a discussion of animal ethics, writes that "given the dependence of your existence on events affecting the moment of your conception, you might easily not have been born. If your father had not met your mother—that sort of thing" (Korsgaard 2018: 5.3.5). Michael Dummett, in a discussion of identity, argues as follows:

> [W]e cannot push back the moment in respect of which a property is to be characterized as presently accidental behind the point at which the object came into existence: that is why, in the case of a human being, his parentage and even the moment of his conception seem absolutely necessary to his identity (Dummett 1973: 131; quoted in McGinn 1976: 130).

Melinda Roberts and David Wasserman, in an introduction to an anthology on harming future persons, evince their commitment to IDENTITY when they write that "[a] woman who chooses to have a child with one partner rather than another chooses more than her partner. She also 'chooses' her child" (Roberts and Wasserman 2009: xv). Similarly, David Heyd, in his contribution to that same anthology, asserts that "I cannot regret not having been born [...] to different parents because it would not have been (numerically) me" (Heyd 2009: 19).

Heyd's claim about regret illustrates why IDENTITY has become so important. Consider the following thesis about harm:

HARM An agent A is harmed by H only if A is better off in a nearby world in which H does not occur.

From the conjunction of IDENTITY and HARM, it follows that no agent can be harmed by virtue of the identity of her parents, for different parents would have had a different child and, thus, no cross-world comparison is possible. This is what underlies the so-called nonidentity problem, and it is under the aegis of this problem that IDENTITY has become so widespread.

Indeed, according to the *Stanford Encyclopedia of Philosophy* (SEP) entry on the nonidentity problem, "the identity of each person who ever comes into existence [...] depends [...] on just who the genetic parents of that person happen to be" (Roberts 2019: section 2). As with Kripke and DeGrazia, the SEP defends IDENTITY on the basis of gamete essentialism, and this is then used to leverage a series of well-known nonidentity cases, including, for example, "14-year-old girl," from Parfit. The idea behind this case is that, when faced with the choice of having a child at the age of 14 or waiting several years, one might think that a 14-year-old girl should wait at least in part because a child will be harmed by being born to a 14-year-old

mother rather than a mother who is several years older. But, according to the nonidentity problem, that thought is wrong, for the decision to wait a few years will change the identity of the egg fertilized during conception and, a fortiori, the identity of the resulting child: "that particular child could not have existed at all had the girl waited until she was older to have a child" (Roberts 2019: Section 2.3).[1]

There are two things that are notable about this. The first is that there are other variants of the nonidentity problem. Probably the most famous one involves the question of whether we should deplete our resources or try to conserve them for future generations. Because this decision will influence mating patterns (including timing and manner of conception), it turns out that it, too, is identity-determining, and so any reason to avoid depleting resources cannot derive from the harm it would do to these future generations (or so the argument goes).

The second is that there is a nonidentity problem entry not only in the SEP, but also in the *Encyclopedia Britannica* and in *Wikipedia*. The nonidentity problem is discussed in the *Internet Encyclopedia of Philosophy* entry on "Environmental Ethics," and there are two videos devoted to it at the Khan Academy. Philpapers, which describes the subcategory of "population ethics" as consisting of two topics, population axiology and the nonidentity problem, lists an overwhelming 1000+ papers in a search for this term. In other words, the literature built on the basis of IDENTITY is vast, and it is not confined to academic discourse.

Of course, there has been pushback against many applications of IDENTITY. For example, some have objected that at least some versions of the nonidentity problem rest on a de dicto/de re fallacy. Applied to the depletion case, this means that, although the particular individuals who make up the future generations cannot be harmed by the identity-determining decision to deplete our resources, the future generation can be (Hare 2007).[2] Others point out that there are meaningful notions of harm that do not require cross-world comparisons. For example, if a given action would impinge on flourishing or the ability to realize various potentialities, there is reason not to perform it (Temkin 2012).

But all of this pushback is downstream from IDENTITY. That is, these objections can be accepted without rejecting IDENTITY and, indeed, proponents of these objections do not seem to question IDENTITY. It is therefore somewhat surprising that IDENTITY is rarely defended at any length in the literature—more surprising still when one realizes, as I aim to show in this paper, that the most plausible defenses of IDENTITY do not withstand critical scrutiny.

2. Genetic Considerations

One way in which IDENTITY might be defended is by appeal to genetic considerations. The idea would be that different parents would have children with qualitatively different genomes, and no two individuals with qualitatively different genomes can be numerically identical. Put formulaically, this might be expressed as follows:

[1] As noted in the SEP, this example, from *Reasons and Persons*, was conceived before the development of egg cryopreservation.

[2] This objection arguably traces back to an early reply to Kripke on the part of J.L. Mackie. Mackie confesses to share Kripke's intuitions about origins but explains them away as *de dicto* rather than *de re* necessities, where the *dicto* is supplied by "the way we think and speak [...] how we handle identity in association with counterfactual possibility" (Mackie 1974: 560). As Colin McGinn points out, '*de intellectu*' might be more apt (McGinn 1976: 128).

QUALITATIVEGENES No agent can have qualitatively different genes.

The idea behind QUALITATIVEGENES is that qualitative differences in genetics are inconsistent with numerical identity of the corresponding individuals: if individual A in world W1 and individual B in world W2 have different genes, then A and B are not the same individual.

But QUALITATIVEGENES does not withstand critical scrutiny. One problem with QUALITATIVEGENES is that talk of a human's genome is not well defined. It is difficult even to draw a sharp line between an individual's cells and cells that are merely in some way associated with his body. Discussions of abortion, the microbiome, and cancer bear ample witness to this.[3] But even overlooking this issue about separating self from non-self, not all (in fact not many) of those cells that are unambiguously part of an individual's body will have exactly the same genetic code at any given instant (Strachan and Read 2003). Some (like red blood cells) have no genetic code at all. Others (like white blood cells) have large differences in their genetic code. Not only is there no uniquely "human" genome, but, more, there is not even a unique genome that can be assigned unproblematically to a single individual.[4] To give a slightly different hue to Raskolnikov's apt lament: "life would be too simple if it were so."

Now a proponent of genetic considerations might be undeterred by this. He might concede that it is difficult to parse out the role for genetics in adult personal identity. But IDENTITY is not really about that: it is about events that cause an individual to come into existence. So, focusing on adults is misguided: the focus should be on embryos, and a proponent of genetic considerations might argue that QUALITATIVEGENES, although not universally true, certainly is true for embryos, a thesis that might be called QUALITATIVEGENESembryo.

To get to IDENTITY, QUALITATIVEGENESembryo then can be coupled with another thesis:

DIFFEMBRYOS Different individuals cannot produce genetically identical embryos.

Moreover, DIFFEMBRYOS need not be the end of the argument. DIFFEMBRYOS can be defended on the basis of a similar thesis about gametes:

DIFFGAMETES Different individuals cannot produce genetically identical gametes.

Seeing this, some might want to bypass DIFFEMBRYOS, appealing to something like QUALITATIVEGENES for gametes and some sort of bridge principle from genetically different gametes to genetically different embryos.[5]

[3] See, for example, Kukla and Wayne 2018, Douglas 2018, and DeVita et al. 2020, respectively.

[4] The issue is compounded by the fact that the genetic code in individuals' cells changes through time. Additional complications arise once we begin thinking about epigenetic markers. There is no unique genome (or proteome for that matter) associated with any given individual from conception (assuming, for the sake of argument, that there is an individual at conception) to death (or even to birth) that contains all but only that individual's genetic (or proteomic) material at a given time.

[5] It is important to realize, however, that someone could defend DIFFEMBRYOS without defending DIFFGAMETES. Fusion of gametes is a complicated process, and it is logically, physically, and biologically possible for two gametes to combine in different ways to

The problem with this strategy is that QUALITATIVEGENESembryo, DIFFEMBRYOS, and DIFFGAMETES are all false. DIFFEMBRYOS and DIFFGAMETES are good generalizations: it is unlikely that any different individuals ever have produced genetically identical gametes.[6] Similarly, it is unlikely that any different individuals ever have produced genetically identical embryos. But generalizations do not help here: DIFFEMBRYOS and DIFFGAMETES are very strong claims. To provide an adequate basis for IDENTITY, DIFFEMBRYOS and DIFFGAMETES must be necessary truths, and that is why they fail.

Not only is it logically, physically, and biologically possible for individuals to produce genetically identical gametes or embryos, but, more, modern technology is making this possibility ever easier to attain. Cloning services already exist for bereaved pet owners who would like a new pet that will resemble the old one (Halow 2021). And however misguided some of us might think such services, the fact is that they exist, that they point toward the (logically, physically, and biologically) possible, and that it is easy to imagine a more macabre scenario in which these services are offered for bereaved parents, bereaved partners, and the like.

This suggests not only that the converse of QUALITATIVEGENESembryo is false, but also that getting from QUALITATIVEGENESembryo to IDENTITY might be quite challenging. More importantly, it points to why QUALITATIVEGENESembryo itself is false. Gene editing technology already exists and has been applied to embryos and gametes alike (Ledford 2020). Some of these techniques leave questions about the resulting embryo. For example, in so-called "three person baby" scenarios (when the mother has a mitochondrial disease), which I shall explore in more detail below, one might wonder whether the resulting embryo, genetically distinct from all of the cells from which it is derived, is *de novo* or identical to one (or more than one) of these cells (Reznichenko et al. 2016). But other techniques are less ambiguous: a point mutation in a non-coding section of DNA is not plausibly going to change the identity of a gamete or an embryo.[7] To make this more concrete, consider the following scenario. Suppose that a medical doctor in a fertility clinic induces two gametes to fuse in a petri dish. Meanwhile, on twin earth, which resembles our earth in every particularity up until this time, the medical doctor is inducing the gametes to fuse in the same petri dish when there is a spontaneous mutation of one nucleotide in a non-coding stretch of unambiguously "junk" DNA (a mutation that, ex hypothesi, makes no difference to the status of this stretch of DNA as junk DNA). To my mind, it is implausible to say that the resulting embryos are not the same, and in light of these difficulties I suspect that most proponents of IDENTITY would back away from

produce genetically different zygotes. Moreover, the development of a multicellular embryo is both highly complicated and highly sensitive to environmental cues; it is logically, physically, and biologically probable that two genetically identical zygotes in distinct environments would develop into genetically different embryos in the sense that, if someone were to sequence all the genetic material (including, e.g., mitochondrial DNA) in every cell of both embryos (assuming for the sake of argument that their development is arrested at a point at which both have the same number of cells), the probability of an exact match is vanishingly small.

[6] Indeed, it is unlikely that any two gametes produced by a single individual ever have been genetically identical.

[7] Would two? Or three? What if every time a new point mutation is introduced, the old one is corrected? The ship of Theseus looms.

genetic considerations. Nonetheless, they might argue, with Kripke, that numerically different gametes will produce numerically different individuals (regardless of whether they are genetically identical). So that is what I turn to now.

3. Gamete Essentialism

As noted in the final paragraph of the last section, an alternate route to IDENTITY, the route affirmed by Kripke, the SEP, and many others, is via the following thesis:

GE (Gamete Essentialism) No embryo can have been produced from other gametes (other than the ones from which it was produced).[8]

GE is not sufficient on its own to get to IDENTITY. Some additional premise is needed. The following will do:

GEBRIDGE No gamete can have been produced from another individual (other than the individual who produced it).

The conjunction of GE and GEBRIDGE entails IDENTITY. But is either thesis true?

Let me begin with GEBRIDGE. This premise is obviously problematic given the prevalence of gamete donation in today's world. Sperm, eggs, and embryos can be frozen, indefinitely as far as we know, and implanted in a time and place very different from that in which they were donated (Estudillo et al. 2021). Moreover, there are medical reports of both ovary and testicle donation in humans and subsequent successful pregnancies (Blake 2013: section I). Thus, different individuals very well could use the same gametes that other individuals would have used.[9] Indeed, it happens, if not frequently, then at least not entirely infrequently.

This might seem like a cheap trick (McGinn 1976: 131). But in considering something like massive climate change and depletion of resources, this is highly relevant. One scientific project currently underway is to collect seeds from currently living flora into a seed bank, in part so that some future generation might be able to revive them should this become necessary (Geiling 2016). Alongside these seed banks one can imagine massive storage units for human gametes taken from all humans of reproductive age, with some gene editing on the side.

It might be objected that these gamete storage units are somewhat farfetched. Moreover, even granting this improbable scenario, it is even less likely that the gametes would be combined in such a way as to produce the same embryos, generation after generation, as would come into being in a world in which climate change were curbed.

But remember: IDENTITY is a very strong claim. For it to do the work that proponents of the nonidentity problem need it to do, it must be a necessary truth; otherwise, HARM will not connect up (that is, otherwise cross-world comparison will be possible, and with such comparisons come claims about harm). So, the

[8] Nathan Salmon suggests that Kripke intended to derive GE from his theory of reference and then argues that any such derivation would be question-begging (Salmon 1979).

[9] Further support for this thesis can be derived from non-physiological theories of personal identity. For example, consider a theory of personal identity based on immaterial souls and suppose (as proponents of such theories often do) that souls can swap bodies. Then not only does DIFFGAMETES fall, but also the bridge principle needed to get from GE to adults falls with it (for the same soul could be joined to different embryos).

mere fact that the scenario I just envisioned is unlikely is irrelevant. The point is that it is possible.

However, there is, I think, a deeper problem with GE: it simultaneously takes into account too little and too much. Let me explain.

The intuition behind GE is that causal origin stories are identity-determining (this, indeed, is where Kripke is driving—and McGinn, writing in Kripke's wake, defends GE on the basis of ideas about fusion: McGinn 1976: 133). But far more plays a role in the causal origin of an embryo than the gametes. For an illustration of this, consider intracytoplasmic sperm injection (ICSI), a technique used in some cases of *in vitro* fertilization, in which a single sperm is injected directly into the cytoplasm of an egg with a syringe (Palermo et al. 1995). GE does not mention how the gametes come together and, thus, it is consistent with denying that the causal role played by the syringe in ICSI is relevant to the identity of the embryo. That is, if a different syringe had been used, that need not have changed the identity of the embryo; not so if a different sperm or egg had been used.

But the syringe plays a role in the causal origin of the embryo if ICSI is in fact used. Thus, the intuition that supports GE also supports the claim that the particular syringe used in ICSI is determinative of the identity of the resulting embryo. Thus, GE takes too little into account.

Now it is important not to misunderstand the point I am making. I am not saying that the syringe should be determinative of the identity of the resulting embryo when ICSI is used. Far from it. The point is that GE seems to build on the idea that causal origin stories are important in determining identity, and *if* causal origin stories are so important, *then* the syringe should be important too.

A proponent of GE might object that, although the syringe plays a causal role in the formation of the new embryo, its particular identity does not. That is, some other syringe could have filled the role played by the actual syringe and the same embryo nonetheless could have been formed. Thus, the identity of the actual syringe is incidental to the identity of the embryo.

The problem with this objection, however, is that it is question-begging. That is, an opponent of GE might object that, although the gametes play a causal role in the formation of the new embryo, their particular identities do not: some other gametes could have filled the roles played by the actual gametes and the same embryo nonetheless could have been formed. Thus, the opponent of GE would conclude, the identity of the actual gametes is incidental to the identity of the embryo.

To see the force of this reply to the proponent of GE, I want to turn to the second half of my claim above, that GE takes too much into account.

There is no obvious reason why the scope of the causal origin intuition should be limited to embryos. To be sure, there are important differences between embryos and gametes: the former are produced by cell fusion whereas the latter are produced by cell division, and so the causal origin stories will be somewhat different. But that seems irrelevant and, indeed, GEBRIDGE is an effort to capture exactly this idea.[10] But absent some independent criteria of identity, this leads

[10] See, for example, McGinn: "The union of human gametes is a special case of biological fusion [...] Thinking of fusion we naturally turn to fission, and here again it seems that the entities that result from a given entity by fission couldn't have come into existence by the fission of a distinct entity, or indeed in any other way" (McGinn 1976: 133).

to an obvious regress problem. This is the first hint that GE is taking into account too much.

The hint becomes stronger with the following kind of consideration. One of the advantages of ICSI (from the perspective of fertility specialists) is that it eliminates many stages of normal fertilization, stages when things might go wrong (Palermo et al 1995). For example, the sperm no longer need to swim toward and find the egg, and they also no longer need to break through the egg's protective layers to deposit their payload. Thus, when ICSI is used, many parts of the sperm cell, including the long tail used to propel it and the enzymes in its head, become superfluous and, indeed, according to some, perhaps even deleterious.[11] So, not only would it be possible, but it very well may be common (at least in some fertility clinics), in the near future for a sperm cell to be selected and destroyed after its genetic material has been transferred directly into the egg. And if this were to happen, then common usage seems to suggest that this is merely an alternate means of creating the same embryo notwithstanding the fact that the causal role of the sperm cell itself, which effectively would be destroyed before the fertilization even takes place, is quite tenuous.[12]

Now a proponent of GE might not be willing to budge quite yet. She might assert that this is not really a counter to GE: the same gametes are playing a causal role in the genesis of the embryo, it is merely that the causal process is slightly different. Just as conventional fertilization differs from ICSI, so conventional fertilization and ICSI both differ from the method envisioned in the previous paragraph. But GE is not about the causal mechanism; it is about the individuals on either side of the causal mechanism. And if this is not really a counter to GE, a fortiori it does not show that GE takes too much into consideration.

I am skeptical of this reply; I suspect that it rests on an unsustainable understanding of causal mechanisms. But even if my skepticism proves ungrounded, the idea behind the reply is easily obviated by an additional step in the process, one that simultaneously will make for an unambiguous counterexample to GE and also lend weight to the assertion that the identity of the actual gametes is incidental to the identity of the embryo.

One of the techniques (there are others) for creating a three-person baby involves creating a "hybrid" egg (Reznichenko et al. 2016). Begin with two eggs, one from the mother with a mitochondrial disease and one from a healthy donor. Both eggs are enucleated and the nucleus from the diseased egg is placed in the healthy egg. The resulting hybrid egg is then fertilized and the diseased egg and other nucleus are destroyed.

The fact that the hybrid egg has nuclear genetic material from one person and mitochondrial genetic material from another raises deep questions about identity and the nature of parenthood. Fortunately, however, such questions can be sidestepped here. Such questions can be sidestepped here because the scenario I want to envision is, although similar, different in relevant ways. The scenario I want to envision is, appropriately enough, a hybrid of the two previous scenarios. Let me explain.

[11] The enzymes used in acrosome might be harmful to the egg when introduced directly into its cytoplasm (Morozumi and Yanagimachi 2005).

[12] This point and the next one require some cleaning up in order to take into consideration the possibility of recombinant mitochondrial DNA.

Suppose that, instead of inserting directly into an egg the genetic material removed from a sperm as described above, a second sperm is selected (from the same donor). Suppose then that the genetic material from that second sperm cell is removed, discarded, and replaced with the genetic material from the original sperm cell with which we started. That new sperm cell is then used to fertilize the egg.

We might pause to wonder what the purpose of such a procedure would be. Perhaps the original sperm had a damaged flagellum but its genetic material has the key to some trait the prospective parents want their future child to have. Or perhaps the procedure is carried out merely to see whether it is possible, or to increase our knowledge about the process of fertilization. The purpose might seem irrelevant, but seeing that it is within reach can help to make the thought experiment more realistic.

In any case, the question now is: has the identity of the resulting embryo changed as a result of this added step in the procedure? My intuitions yield a firm "no". In my view, the encasing sperm in this case is a transport vehicle: it has precious cargo, but the cargo is what matters. And if I am right about this, then GE should be discarded.

I suppose that a hardline essentialist might replace GE with an alternate thesis. The idea that it is the sperm's cargo that matters rather than the sperm itself points toward the importance of genetic considerations, and this might suggest the following thesis to some:

GGE (Gametic Gene Essentialism) No embryo can have had other genes (other than the ones that it actually has from the gametes that fuse to form it).

But this is no longer gamete essentialism, and I want very much to note that fact. So I turn now to section 4.

4. Genetic Considerations Again

I want to begin my attack on GGE by noting that it is in need of precisification. We arrived at GGE by a thought experiment involving the use of a gamete's nuclear DNA even while the cell itself was destroyed. So, it is tempting to think that GGE is about nuclear DNA.

But the thought experiment had that form only for the sake of simplicity. As the discussion of three person babies revealed, nuclear DNA is not the only kind of DNA to be found in an embryo; there is also mitochondrial DNA, and mitochondrial DNA is far from an idle wheel.

I do not want to take a stand here on whether the three person babies in section 3 can be two person babies in other worlds. However, I do want to point out that, if GGE is true but refers only to nuclear DNA, then three person babies, or at least the zygotes that develop into them, can be two person babies (zygotes), whereas if GGE is true and refers also to mitochondrial DNA, then they cannot.

This is not, in itself, an objection to GGE. Indeed, proponents of GGE might divide on this front. Some might defend the importance of mitochondrial DNA to (numerical) identity; others might eschew it. The point I want to make is that GGE might seem to be a simple idea. But underneath that seeming is a legion of complications. This will become more relevant shortly.

The second point I want to make is that, regardless of whether GGE refers to mitochondrial DNA, it is very hard to defend. Seeing why that is so will help to elucidate the nature of the thesis.

GGE cannot be defended on the basis of considerations regarding the information conveyed in the genetic material in question. This should be unsurprising given the foregoing (and, in particular, the arguments in section 2). For one thing, if the arguments in section 2 work, then the information conveyed by a single packet of genetic material, whether gamete or embryo, is modally fragile. For another (conversely), it is uncontroversial that numerically distinct packets of genetic material can have exactly the same information, whence it follows that, if GGE is true, numerically distinct embryos can have identical genetic information.

GGE also cannot be defended on the basis of general causal considerations. As seen in section 3, this would have the absurd result that the identity of the particular syringe used in ICSI plays a role in determining the identity of an embryo. It also would entail the less absurd but (as hopefully convincingly demonstrated) nonetheless false result that the identity of a particular gamete plays a role in the identity of the resulting embryo.

Finally, GGE cannot be defended on the basis of temporal anchoring, the idea that something's identity is determined by its time of origin. I do not want to attack temporal anchoring in general. Rather, the problem that is relevant for current purposes is that temporal anchoring, like causal anchoring, is neither necessary nor sufficient for showing that a particular packet of genetic material is essential to the (numerical) identity of an embryo.

The challenges associated with finding a philosophically probative defense of GGE, like the challenges associated with its precisification, do not, in themselves, pose a problem for GGE. There might be another defense out there that I have not considered. Moreover, argument must end somewhere: perhaps GGE is intuitive bedrock, where the argumentative buck stops. Or to put the point with an ironic twist, genetic considerations can be helpful in figuring out whether a claim is true, but they are not determinative. Nonetheless, I suggest that these two points should raise red flags. And now I want to try to make good on that.

Begin with the position that mitochondrial DNA is included in GGE. We shall put this position down momentarily. But it is useful to start with it in order to loosen up intuitions.

The thing about mitochondria is that they come in large numbers, and the different mitochondria might have different DNA (Scheffler 2007). It is for this reason that an individual with a mitochondrial disease might have some (indeed, many) healthy mitochondria, even in tissues affected by the disease.

So suppose that we take a healthy egg and remove one mitochondrion from it prior to its fertilization. Are we going to say that the resulting zygote is not identical to the zygote that would have resulted had this mitochondrion not been removed? My intuition is a firm "no". And if your intuitions agree with mine, that is enough to render the mitochondrial version of GGE unsustainable for you.

Note that this does not require taking a stand on three person babies. It might be the case that switching out all of the mitochondria (along with other organelles) is sufficient to change identity. The point is that switching out one is not sufficient to change identity, but it is sufficient to change the (mitochondrial) genetic material in the resulting embryo, especially if it is replaced by another mitochondrion (one from a different cell from the same person to avoid potential complications).

A proponent of GGE might object that switching out a single mitochondrion is not sufficient to change the identity of the egg, and that is why it is not sufficient to change the identity of the resulting embryo. In just the same way that we might

switch out a single motor on a plane or boat with multiple motors without changing the identity of the craft, a single mitochondrion might be switched out without changing the identity of a gamete.

But this objection does not help the proponent of GGE. It would have helped if we still were discussing gamete essentialism. But we have moved on. Now we are discussing gametic gene essentialism. So, the fact that the gamete can be preserved through changes in its genetic material, especially if coupled with the thesis that identical gametes can produce identical embryos, only drives home the fact that gametic gene essentialism is not a good criterion for embryo identity.

Alternatively, a proponent of GGE might point out that this is predicated on taking GGE to concern mitochondrial DNA. That is true, and deliberately so. So let us drop that stipulation now.

The reason I do not think that dropping this stipulation will help is that nuclear DNA is not a single, let alone a simple, substance (or, if you prefer, process). Each gamete typically has 23 chromosomes, the smallest consisting of tens of millions of base pairs, each base pair in turn consisting of more than 50 atoms, each atom in turn consisting of multiple subatomic particles, and so on down the line (Lewis 2017). And then there is the packaging of the DNA: the histones and other proteins, huge molecules in themselves, that enable the DNA to be wound up into coils of chromatin.

My intuition is that if we knew how (we do not, but if we did) we could switch out every one of the histones and epigenetic markers from a given set of chromosomes and that this switching need not have any effect on the identity of the gametic nuclear DNA, the gamete itself, or the resulting zygote. If this intuition is right, then GGE can be sustained only if it refers solely to the actual DNA in a given gamete, not to the packaging of this DNA. I bring this up only to point out that it raises another difficulty for any attempt to defend GGE on the basis of more general considerations. But what about GGE itself?

My intuition is that a single chromosome could be replaced entirely with a qualitatively identical one without altering the identity of the resulting zygote. And as with the mitochondrion thought experiment, an analogy can illustrate the plausibility of my intuition: just as a single processor can be switched out in a computer without altering the identity of the computer, or a single person can be switched out without altering the identity of a group, so a single chromosome can be switched out in a gamete without altering the identity of the gamete or, perforce, the resulting zygote (this analogy can be tightened if the computer is a DNA computer).

If you are still unconvinced, consider that some chromosomes play no role in embryonic (or subsequent) development. For instance, in individuals with more than one X chromosome (46 XX; 47 XXY; 47 XXX), typically only one of the X chromosomes is active in each cell (Alberts et al. 2002). Suppose, as is possible although not necessary, that it is the same X chromosome that is active in each cell. Now suppose that it is (one of) the inactive X chromosome(s) that is switched out. My intuition here, as before only more certain, is that the identity of the resulting embryo would be unaffected.[13]

[13] If I am right about this, then it undermines not only GGE, but also other, less popular defenses of IDENTITY, like the one advanced by Graeme Forbes: "what is important to the identity of the organism is the identity of the matter from which it originates, together with the configuration of that matter" (Forbes 1986: 8).

But perhaps it will be objected that my claim above about group identity serves to undermine my own counterexamples in this section. The idea behind this objection is something like the following. My counterexamples work against what might be called individual gametic gene essentialism, the view that every single piece of DNA in the embryo, either mitochondrial or nuclear, must be identical to the DNA in the gametes in order to preserve embryonic identity. But my counterexamples do not work against what might be called group (or, perhaps, vague) gametic gene essentialism, the view that the set of DNA in the embryo, perhaps including mitochondrial DNA, perhaps not, must be identical to the sets of DNA in the gametes in order to preserve embryonic identity. (This of course assumes that the identity of the set of the DNA is not reducible to the identities of its members (so perhaps the word 'set' is infelicitous).)

I would like to say two things about this. First, I want to point out that the most obvious rationale for this view, gamete essentialism, already has been defused. Second, note that, if the set of genes is being conceived of as having a group identity like a company or a state, then (also like a company or state) presumably every member could be switched out without injury to the identity of the group. I have no objection I want to press here against this hypothesis per se. But I do want to point out that, in the current context, it is a nonstarter: it effectively severs gametic gene essentialism from IDENTITY. So, regardless of whether this is the route you want to go, you should agree with me that gametic gene essentialism is not a good defense for IDENTITY.

5. Conclusion

In this paper I have argued against a popular thesis in contemporary philosophy, the thesis that it is impossible for a child to have had different parents (IDENTITY). I argued against this thesis by confronting what I take to be the most popular and most promising defenses of it, arguments based on genetic considerations and arguments based on gamete essentialism. I maintain that these arguments all fail, either because their central assertions are false, or because they rely on bridge principles that are false, or both.

However, it is worth pointing out that, even if my arguments in this paper are successful, they do not show that IDENTITY is false: they show, at most, that IDENTITY has not been adequately defended. In closing I would like to say two things about this.

First, I think that to press for a direct counterexample to IDENTITY would be to mistake the nature of the current dialectic. As I tried to illustrate in section 1, IDENTITY has not emerged in a vacuum; it has emerged as a thesis that is supposed to ground various results in the fields of environmental ethics, population ethics, parenting, and so forth, results that are supposed to be surprising. To put this another way, the dialectic has the following form: "X [obviously]", "no, X is false [!] because IDENTITY". So, it seems to me that the appropriate way to attack IDENTITY at this point (to avoid a simple game of modus tollens/ponens) is by attacking the most plausible ways of defending IDENTITY. And that is what I sought to do in this paper.

Second, my hope is that attacking the basis of IDENTITY will suffice at least to call it into question and to spur on its adherents to offer a more spirited argu-

ment in its favor. For if no such argument is forthcoming, then the notion of genetic parenthood is as fraught as the notion of parenthood itself, and a large body of work spanning multiple sub-disciplines in philosophy will have to be rethought.

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