

## **DEFINING LIFE FROM DEATH: PROBLEMS WITH THE SOMATIC INTEGRATION**

### **DEFINITION OF LIFE**

#### **ABSTRACT**

To determine when the life of a human organism begins, Mark T. Brown has developed the somatic integration definition of life. Derived from diagnostic criteria for human death, Brown's account requires the presence of a life-regulation internal control system for an entity to be considered a living organism. According to Brown, the earliest point at which a developing human could satisfy this requirement is at the beginning of the fetal stage, and so the embryo is not regarded as a living human organism. This, Brown claims, has significant bioethical implications for both abortion and embryo experimentation. Here, we dispute the cogency of Brown's derivation. Diagnostic criteria for death are used to determine when an organism irreversibly ceases functioning as an integrated whole, and may vary significantly depending on how developed the organism is. Brown's definition is derived from a specific definition of death applicable to postnatal human beings, which is insufficient for generating a general definition for human organismal life. We have also examined the bioethical implications of Brown's view, and have concluded that they are not as significant as he believes. Whether the embryo is classified as a human organism is of peripheral interest—a far more morally relevant question is whether the embryo is a biological individual with an identity that is capable of persisting during development.

## INTRODUCTION

According to Mark T. Brown<sup>1</sup>, determining when the life of a new human organism has begun is an important question because of its significant bioethical implications. If the zygote and embryo<sup>2</sup> are not human organisms, he believes it is difficult to see how they can possess moral status comparable to an adult human organism, and consequently possess human rights. He argues that this severely undermines the cases for prohibiting embryo experimentation and abortion prior to 9 weeks gestation.

In an attempt to answer this question of when the life of a human organism begins, Brown presents what he calls the *somatic integration definition of life*. His general approach is to take a familiar definition of human death, derive from it a definition of life, and then use this to show that embryos are not living human organisms—they are merely ‘organic aggregates’. Consequently, early abortions (or the destruction/loss of early embryos generally) are merely ‘interruptions of embryological development prior to the onset of human life’<sup>3</sup>.

Here, we examine Brown’s reasoning and identify some difficulties with his claims. We point out that Brown’s definition of life is derived from a *specific* definition of death developed for determining when the death of a *postnatal human being* has occurred. Consequently, diagnostic criteria for death based on this definition—such as brain death—naturally refer to properties possessed by a human being at this stage of development. Moreover, diagnostic criteria for death are designed to identify sufficient conditions for determining when an organism *irreversibly* ceases functioning as an integrated whole. This is an empirical determination, and may be very different depending on how developed the organism is. This entails that a general definition for life cannot be derived from

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<sup>1</sup> Brown M.T. The somatic integration definition of the beginning of life. *Bioethics*. 2019;00:1–7. DOI: 10.1111/bioe.12638

<sup>2</sup> Technically, the *zygote* is the cell formed as the result of a sperm fertilising an ovum. It divides to form the *blastocysts*, which after implantation will become the *placenta* and *embryo*. For readability, we will use ‘embryo’ to refer to all stages of development until the fetal stage at the ninth week.

<sup>3</sup> Brown, op. cit. note 1, p. 6.

specific diagnostic criteria for determining death. Defining when an organism's life begins must be arrived at *independently* of the definition of the death of an organism (although it may be *informed* by such definitions)<sup>4</sup>.

We conclude that Brown's somatic definition of life is unsubstantiated, and the conclusions he draws regarding the moral status of embryos—and the bioethical implications—are therefore unfounded. Finally, we show that even if embryos are *not* considered human organisms according to Brown's definition, the bioethical implications are more limited than Brown suggests.

## DEFINITION OF DEATH

According to Brown, a widely adopted definition of human death is the 'collapse of somatic integration in the body as a whole'<sup>5</sup>. The term *somatic* means 'body'; somatic integration describes the various parts of the body functioning together as a single entity. Organisms, he states, possess various homeostatic mechanisms that maintain them, and these must be coordinated and regulated with what Brown calls a 'life-regulation internal control system'<sup>6</sup>—the provider of somatic integration. Once this integration irreversibly fails, a human organism is considered dead. Brown's primary claim is that the *level* of somatic integration required for an entity to be considered a living human organism should be comparable to the level of the collapse of somatic integration at the end of life.

Brown's justification for this is based on the brain death criterion for determination of human death, which implies that the brain is the internal control centre that provides somatic integration. He

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<sup>4</sup> Elizabeth Chloe Romanis makes a somewhat similar inference to Brown, stating that 'If a defining characteristic can be isolated that makes a person legally dead, the emergence of that characteristic identifies when a person becomes legally alive.' See: Romanis, E.C. (2019) Challenging the 'Born Alive' Threshold: Fetal Surgery, Artificial Wombs, and the English Approach to Legal Personhood, *Medical Law Review*, 1-31, p. 21. DOI: 10.1093/medlaw/fwz014.

<sup>5</sup> Brown, op. cit. note 1, p. 1.

<sup>6</sup> Brown, op. cit. note 1, p. 3.

addresses two audiences: those who hold to the brain death criterion, and thus the importance of the brain to somatic integration, such as Maureen Condic, and those who deny the brain is essential to somatic integration, such as Alan Shewmon. In the first case, brain death, Brown believes this implies a thalamocortical complex—the thalamus and cerebral cortex—is required for life. He notes that a possible alternative is to require a level of somatic integration demonstrably higher than that exhibited by brain-dead bodies. In the second case—in which brain-dead individuals are still considered to be living—Brown claims whatever life-regulation they exhibit should be the minimum required for determining life. As the second case entails a weaker requirement than the first, Brown adopts it as the basis for his definition of human organismal life, claiming it entails possession of ‘dedicated homeostatic mechanisms that maintain physiological homeostasis conducive to cellular metabolism’<sup>7</sup>.

We can summarise Brown’s reasoning in this way: if a human organism at an advanced stage of development is diagnosed as brain-dead, then human organisms at any stage of development must *exceed* the level of somatic integration the brain-dead organism exhibits to be regarded as living.

Brown argues that such mechanisms are not present in the developing human embryo, and do not emerge until the early fetal stage, or after about 9 weeks of gestation. Consequently, under Brown’s definition of life, he claims that prior to 9 weeks, an embryo is not a living human organism, but rather an ‘organic aggregate’<sup>8</sup>, and therefore lacks any moral status that might be attributed to human organisms. It therefore lacks human rights, and so abortion (prior to 9 weeks gestation) and the use of embryos for research are permissible, unless other grounds are found to confer human rights.

Brown does not attempt to provide a comprehensive argument for his definition: he states that ‘the somatic integration definition of life is *assumed* to be a *prima facie* plausible biological definition of

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<sup>7</sup> Brown, *op. cit.* note 1, p. 2.

<sup>8</sup> Brown, *op. cit.* note 1, p. 4.

organismal life<sup>9</sup> (emphasis ours). We disagree. That embryos sufficiently developed to have a heartbeat<sup>10</sup>, brain activity<sup>11</sup> and spontaneous movement<sup>12</sup> do *not* satisfy Brown's definition and an amoeba *does* satisfy it rather suggests that it is *not a prima facie* plausible definition of organismal life. Substantive justification is required, particularly given the significant bioethical implications he is claiming for his view—and the criticisms we identify below.

Our primary criticism is that Brown's definition of human organismal life is derived from diagnostic criteria for death that have been developed for postnatal human beings—typically those that at a minimum are capable of consciousness and respiration. Thus, these criteria define the sufficient conditions required to issue a pronouncement of death for human organisms *that have reached this level of development*. Brown's definition of life, being derived from these criteria, therefore implicitly *assumes* some characteristics of an advanced stage of an organism's development are required for life without demonstrating that they are *necessarily* required for life at any developmental stage. That a developed living human organism requires a certain level of somatic integration to be distinguished from a dead human organism at a similar stage of development does *not* entail that a human entity at a very different stage of development requires an equivalent level of somatic integration to be judged as alive. This is a confusion of two different concepts: determining if an entity is alive at *any* stage of development, and determining if an entity is alive at a *particular* stage of development. But as D. Gareth Jones explains, 'definitions of death apply specifically to those who are dying, not to those who are developing. Development and degeneration are not interchangeable'<sup>13</sup>.

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<sup>9</sup> Brown, op. cit. note 1, p. 2.

<sup>10</sup> Brown, op. cit. note 1, p. 6.

<sup>11</sup> Borkowski W.J., Bernstine R.L. (1955). Electroencephalography of the fetus. *Neurology*. 5(5):362–365.

<sup>12</sup> 'Embryos in the sixth week show spontaneous movements' in Moore, K., Persaud, T., Torchia, M. (2019). *The Developing Human: Clinically Oriented Embryology*. 11th edition. Philadelphia, PA. p.65-84.

<sup>13</sup> Jones, D. G. (1998). The problematic symmetry between brain birth and brain death. *Journal of Medical Ethics*, 24(4), 237–242.

An analogy here might be helpful. Let us take the example of a simple plastic model assembled from a dozen pieces—a model aircraft, for example. The model is ‘working’ if those pieces are assembled correctly, and ‘broken’ if some of the pieces are missing or if it is split into two smaller assemblies—what we might call *model aggregates*. Here, ‘working’ is analogous to being alive, while ‘broken’ is analogous to being dead. Now consider a very complicated model consisting of many thousands of pieces—for example, a model of an aircraft carrier. If this model was separated into a few parts with each part consisting of hundreds of pieces, it would be broken (dead)—and yet each of these parts would be vastly more complex and integrated than our simple model. Some parts might even be thought of as functional (i.e. complete)—such as its power plant—but the model aircraft carrier would still be broken. The parts would still only be model aggregates.

In a similar way, a biological human at a very early stage of development might well have a level of somatic integration that appears less than that of a more developed organism that has just been declared dead. The comparison, however, is invalid. The crucial point is that death is *irreversible*—a widely accepted biological definition of organismal death is ‘irreversible cessation of functioning of an organism as a whole’<sup>14</sup>. An organism that has been declared dead may still be somatically integrated at a relatively high level for a period of time, but if it can never *return* to a higher level of somatic integration and will continue to deteriorate without artificial aid, it is dead. Diagnostic criteria for death are developed based on empirical knowledge about the level of somatic integration below which the deterioration of the organism is known to be irreversible—and this level differs depending on how developed the organism is. This explains why a *general* definition of life at all stages of development cannot be derived from a definition of death at a specific stage of development—because ‘development and degeneration are not interchangeable’<sup>15</sup>.

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<sup>14</sup> Brugger, E. C. (2016). Are Brain Dead Individuals Dead? Grounds for Reasonable Doubt. *Journal of Medicine and Philosophy*, 41(3), 329–350.

<sup>15</sup> Jones, op. cit. note 13, p. 241.

## WHAT IS A HUMAN ORGANISM?

Given that we have rejected Brown's definition of organismal human life as generally applicable to all stages of development, we need to examine alternative definitions of living organisms from the subject matter experts—biologists and philosophers of biology—and determine if embryos qualify. If they are clearly excluded, disagreement with Brown is moot.

We quickly run into difficulties—according to John W. Pepper and Matthew D. Herron<sup>16</sup>, there is widespread disagreement regarding what entities qualify as organisms, and consequently there are numerous competing definitions. Some biologists doubt that a unified concept of an organism is possible, and Pepper and Herron conclude that 'the diversity of life is so great that a single organism concept cannot usefully be applied to all forms for all purposes'<sup>17</sup>. Jan Baedke explains how the importance of the organism has waxed and waned in biology, and notes that 'organisms are ambiguous units'<sup>18</sup>. New research forces continual re-evaluation and modification of existing definitions—for example, Patrick Forterre argues that viruses should be classified as organisms based on recent discoveries<sup>19</sup>. Clearly, we need to be cautious not to rely too heavily on one particular definition when considering the bioethical implications.

According to Thomas Pradeu, most biologists conceive of an organism in *general terms* as a 'functionally integrated and cohesive whole made of interdependent and interconnected parts'<sup>20</sup>.

According to Condic, the zygote meets this criterion. She supplies a detailed description of the first

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<sup>16</sup> Pepper, J. W., & Herron, M. D. (2008). Does Biology Need an Organism Concept? *Biological Reviews*. 83(4), 621–627.

<sup>17</sup> Ibid:625.

<sup>18</sup> Baedke, J. (2018). O Organism, Where Art Thou? Old and New Challenges for Organism-Centered Biology. *Journal of the History of Biology*. 52(2), 293–324.

<sup>19</sup> Forterre, P. (2016). To be or not to be alive: How recent discoveries challenge the traditional definitions of viruses and life. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences*, 59, 100–108.

<sup>20</sup> Pradeu, T. (2016). Organisms or biological individuals? Combining physiological and evolutionary individuality. *Biology & Philosophy*. 31(6), 797–817.

five days following sperm-egg fusion together with a comprehensive list of published research to substantiate her claim<sup>21</sup>. She concludes that development of the zygote ‘requires the coordinated interaction of elements derived from both sperm and egg’, and so the zygote ‘functions as an organism’<sup>22</sup>. Brown concedes that this description could be reformulated as evidence of integrated function<sup>23</sup>.

Embryologists Ronan O’Rahilly and Fabiola Müller state that ‘fertilization is a critical landmark because, under ordinary circumstances, a new, genetically distinct human organism is thereby formed’<sup>24</sup>. A recent survey of 5,502 biologists from 1,058 academic institutions found 95% agreed that ‘a human’s life begins at fertilization’<sup>25</sup>. Likewise, philosopher of biology Elliot Sober believes that ‘it is entirely natural to date the beginning of the new organism as the time at which egg and sperm unite’<sup>26</sup>. Apart from Brown’s definition, then, both the zygote and embryo are commonly referred to as human organisms.

## **MORAL SIGNIFICANCE OF ORGANISMS**

We noted earlier Brown’s claim that his definition of a living human organism has ‘momentous bioethical implications for the morality of abortion, assisted reproduction, and embryonic stem cell research’<sup>27</sup>. According to Brown, if human embryos are not organisms, they lack moral status and

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<sup>21</sup> For example, to demonstrate coordinated interaction Condic notes that at sperm-egg fusion there is a ‘rapid initiation of cellular modifications that prevent sperm from binding to the zygote’. This is ‘not required for the health of the zygote as a single cell, yet it is critical for embryonic development’—and therefore a step in the future development path of the organism. The first cell division is controlled by the maternal gene components; at the two-cell stage, developmental control is transferred to the zygotic genome. From this point, ‘the zygote utilizes its own genome to direct development’. Condic, M. (2013). When does life begin? The scientific evidence and terminology revisited. *University of St. Thomas Journal of Law and Public Policy*, 8(1), 44–81.

<sup>22</sup> Condic, op. cit. note 21, p. 68.

<sup>23</sup> Brown, op. cit. note 1, p. 4 (footnote 20).

<sup>24</sup> O’Rahilly, R. & Mueller, F. (2001). *Human Embryology and Teratology*, 3rd edition. New York, NY:Wiley-Liss. p.8. ‘

<sup>25</sup> Jacobs, S. (2018). Biologists' Consensus on 'When Life Begins'. Available at SSRN. DOI: 10.2139/ssrn.3211703.

<sup>26</sup> Sober E., (2000). *Philosophy of Biology*. 2nd ed. Boulder, Colorado: Westview Press. p.154.

<sup>27</sup> Brown, op. cit. note 1, p. 1.



concordant human rights such as a right to life. We have rejected his definition of human organisms, and shown that embryos do qualify as human organisms under Pradeu's definition; we have also shown there is wide agreement amongst biologists and embryologists that embryos *are* human organisms.

However, were we to grant Brown's definition credence and concede that the embryo is not a human organism, the bioethical implications are not as significant as he suggests. To begin with, most ethicists do not ground moral status on whether an individual qualifies as a human organism—typically, they grant moral status based on an individual's possession of certain value-giving properties such as self-awareness, rationality or moral agency. Whether an individual is an organism is primarily a biological question regarding classification, not a moral question. This becomes more apparent when we examine Brown's bioethical implications.

### **Embryo research**

As Brown notes, the 14-day limit on destructive embryo research is based on twinning no longer being possible due to cell differentiation and development of the primitive streak, meaning that the embryo is clearly a unique human individual. By Brown's definition, it is still an 'organic aggregate', not an actual human organism, and accordingly lacks moral status. He therefore believes research should be permitted on in vitro embryos during the third week after fertilisation, if this becomes feasible.

However, Sarah Chan explains<sup>28</sup> that the report<sup>29</sup> produced by the Warnock Committee of Inquiry into Human Fertilisation and Embryology in the UK, which recommended the 14-day limit and led to the

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<sup>28</sup> Chan, S. (2018). How and Why to Replace the 14-Day Rule. *Current Stem Cell Reports*. 4(3), 228–234.

<sup>29</sup> Great Britain & Warnock, M. (1984). *Report of the Committee of Inquiry into Human Fertilisation and Embryology*. London: H.M.S.O.

Human Fertilisation and Embryology Act of 1990, chose not to directly address questions of moral status regarding the embryo. The Warnock Committee considered a range of views, from those regarding the early embryo as a ‘simply a collection of cells which, unless it implants in a human uterine environment, has no potential for development’<sup>30</sup> to those who believe it has the same moral status as an adult. Brown’s conclusion is a similar view to the former. The committee’s grounds for their recommendation of a 14-day limit were the ability to feel pain and individuation (as Brown noted), citing the start of neural development at around 17 days and the formation of the primitive streak after 14 days. The status of the embryo as a human organism seems peripheral to these concerns. Unless future committees on embryo research legislation take a very different approach, this seems unlikely to change.

## **Abortion**

Brown states that according to his definition of organismal life, pregnancy termination ‘prior to fetal development would not violate the human rights of an unborn human being’<sup>31</sup>. He claims that under his definition, a human organism appears only upon commencement of the fetal stage of development, and suggests that ‘the fetus could be considered a human being with moral status that entitles it to human rights, including the right not to be killed unjustly’<sup>32</sup>.

Certainly, most pro-choice ethicists would disagree with assigning a fetus rights on this basis. Most implicitly concede that the embryo *is* a human organism but do not consider that this bestows rights. For example, Peter Singer states that ‘granting that the fetus is a living human being does not resolve the question of whether it is wrong to kill it’<sup>33</sup>. Jeff McMahan<sup>34</sup>, David Boonin<sup>35</sup>, Michael Tooley<sup>36</sup>

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<sup>30</sup> Ibid: 62.

<sup>31</sup> Brown, op. cit. note 1, p. 7.

<sup>32</sup> Brown, op. cit. note 1, p. 7.

<sup>33</sup> Singer, P. (2011). *Practical Ethics*. Cambridge University Press. p. 135.

<sup>34</sup> McMahan, J. (2002). *The Ethics of Killing: Problems at the Margins of Life*. OUP USA.

<sup>35</sup> Boonin, D. (2002). *A Defense of Abortion*. Cambridge University Press. p. 127.

and Mary Ann Warren<sup>37</sup> share this view. They only grant moral status and accompanying rights to *persons*, and argue that being a person requires possession of certain morally relevant properties that we have previously noted. The status of the embryo as an organism plays no part in their deliberations. Even if it is granted that the embryo or fetus *is* a person, this does not necessarily entail that abortion is impermissible—Judith Jarvis Thomson<sup>38</sup> argues that a woman’s bodily autonomy may override that of the embryo or fetus even if it possesses equivalent moral status. Acceptance of Brown’s definition and its applicability to embryos has minimal implications for pro-choice arguments, although we grant it may make these arguments more persuasive.

It might be thought that a determination by Brown’s definition that the embryo is not a human organism would significantly undermine pro-life arguments against abortion. Certainly, primarily rhetorical arguments that refer to embryos as ‘innocent human beings’ would be discredited. However we believe two of the most widely used pro-life arguments would be largely unaffected, as we explain below.

The first pro-life argument is based on the *substance view of persons* (SV) which is grounded in the Aristotelian notion of *substance*. A substance is defined as an individual being with a particular nature. Francis Beckwith characterises human substances, or ‘persons’, as individuals that maintain their ‘identity through change as well as possessing a nature or essence that makes certain activities and functions possible’<sup>39</sup>. According to J.P. Moreland, ‘a substance’s inner nature is its ordered structural unity of ultimate capacities’<sup>40</sup>. Capacities are hierarchical—first-order capacities, second-order capacities to have first-order capacities, and so on, until *ultimate capacities* are reached. Moreland gives the example of someone who can speak English but not Russian—English is a

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<sup>36</sup> Tooley, M. (1972). Abortion and infanticide. *Philosophy and Public Affairs* 2 (1):37-65.

<sup>37</sup> Warren, M. (1973). On the moral and legal status of abortion. *The Monist* 57 (1):43-61.

<sup>38</sup> Thomson, J.J. (1971). A defense of abortion. *Philosophy and Public Affairs*. 1 (1):47-66..

<sup>39</sup> Beckwith F. J. (2004). The Explanatory Power of the Substance View of Persons, *Christian Bioethics* 10:1: 33-54.

<sup>40</sup> Moreland, J.P. (1995). Humanness, personhood, and the right to die. *Faith and Philosophy*, 12(1), 95–112.

first-order capacity while Russian is not, but the person has a second-order capacity to speak both English and Russian. Higher order capacities are *realised* by the development of lower order capacities, and so for living substances, they may not be immediately realisable until lower level capacities have developed. In this sense, human substances have a *rational* nature as they always possess the ultimate capacity for rationality, even if this capacity is not realised until the development process is well advanced. Human substances have intrinsic moral value at all stages of development because they possess this nature. According to the SV, a new human substance is instantiated when fertilisation occurs, and this substance persists through developmental change to adulthood, i.e. the zygote, embryo and fetus and postnatal human are the same human substance, and accordingly have equivalent moral value and possess the same rights. Importantly, being a human substance is *not* dependent on being an organism—what is crucial is maintaining identity through change and its rational nature.

The second pro-life argument is Don Marquis' widely discussed *future-like-ours* argument against the permissibility of abortion<sup>41</sup>. Marquis argues that abortion deprives an *individual* of a future like ours, and that is seriously morally wrong<sup>42</sup>. His argument is also not predicated on this individual qualifying for organism status—all that is required is that it is the *same* individual that persists during and after the development process.

### **Biological individuals**

Interestingly, the requirement for a persisting individual is common to both pro-life arguments and the Warnock Committee's reasoning for applying a 14-day limit to embryo research. Being an organism is not morally significant in this context—being a persisting *biological individual* is. In biology,

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<sup>41</sup> Marquis, D. (1989). Why Abortion Is Immoral. *Journal of Philosophy* 86 (4):183-202.

<sup>42</sup> Marquis' 'future like ours' argument is consistent with animalism but it is not necessary for the argument to be cogent.

‘individual’ and ‘organism’ have traditionally been used interchangeably, but increasingly, it is being argued that biological individuals are not necessarily organisms<sup>43</sup>. Thus even if Brown’s definition for a human organism is accepted and we grant it applies to the embryo, provided it is a biological individual that persists through to adulthood, its failure to qualify as a human organism is not morally relevant. Because of the possibility of twinning in the first 14 days, an argument can be made that a distinct biological individual is only created once this limit is passed. In response, S. Matthew Liao points out that an amoeba’s potential to split does not preclude it being an individual<sup>44</sup>, while Samuel Condic and Maureen Condic note that there is no evidence that an individual dies upon twinning, and so it cannot be assumed the original individual ceases to exist<sup>45</sup>. In practice, because pregnancy is not reliably detected within this period<sup>46</sup>, almost all abortions occur after this point in pregnancy.

This raises the question of how a biological individual is defined, and whether the embryo persists as the same biological individual during development. As with ‘organism’, there are numerous concepts of biological individuals. Jack Wilson defines a *genetic individual* as a biological entity whose ‘parts share a common genotype because of descent without interruption from a common ancestor with that genotype’<sup>47</sup>. Importantly for our purposes, a ‘new genetic individual, initially composed of the zygote, persists from that time until no cell descended from that cell with that genotype exists’<sup>48</sup>. Wilson also recognises the *developmental individual*, which ‘persists for as long as the developmental process continues or the adult multicellular body exists’<sup>49</sup> and begins with the zygote. Pradeu defines a *physiological individual* as a ‘physiological unit, that is, a functionally integrated and cohesive

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<sup>43</sup> e.g, Pradeu, op. cit. note 20, p. 799; Wilson, R. A. (2004). What Is an Organism? In *Genes and the Agents of Life* (pp. 47–69). Cambridge University Press. p. 59; Dupré, J., & O’Malley, M. A. (2009). Varieties of Living Things: Life at the Intersection of Lineage and Metabolism. *Philosophy and Theory in Biology*, 1(20170609).

<sup>44</sup> Liao, S. M. (2010). Twinning, inorganic replacement, and the organism view. *Ratio* 23 (1):59-72.

<sup>45</sup> Condic, S. & Condic, M. (2018). *Human Embryos, Human Beings: A Scientific and Philosophical Approach*. Washington, D.C.: Catholic University of America Press. p. 91.

<sup>46</sup> Cole, L. A. (2010). Pregnancy Testing. In *Human Chorionic Gonadotropin* (pp. 281–286). p. 284.

<sup>47</sup> Wilson, J. (1999). *Biological Individuality: The Identity and Persistence of Living Entities* (Cambridge Studies in Philosophy and Biology). Cambridge: Cambridge University Press. p. 86.

<sup>48</sup> Ibid:87.

<sup>49</sup> Ibid:106.

metabolic whole, made of interdependent and interconnected parts<sup>50</sup>. It has been long recognised<sup>51</sup> that the zygote and preimplantation embryo both have an active and rapidly increasing metabolism; the blastocyst and cell differentiation begins very early, at the blastocyst stage<sup>52</sup>, so the embryo appears to be a unified entity following a development path. It also possesses interdependent and connected parts, and so can be regarded as a physiological individual. To reinforce this claim, we can also recall Maureen Condic's description of the coordinated interactions driving development of the zygote, that in her view qualified the zygote as an organism.

It is clear that on these definitions the embryo is a biological individual, and maintains its identity as that individual until adulthood—it is the same genetic individual, the same development individual (being part of the same development process), and the same physiological individual<sup>53</sup>.

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<sup>50</sup> Pradue, op. cit. note 20, p. 807.

<sup>51</sup> Leese, H. J. (2012). Metabolism of the preimplantation embryo: 40 years on. *Reproduction*. 143(4), 417–427.

<sup>52</sup> Adjaye, J., Huntriss, J., Herwig, R., BenKahla, A., Brink, T. C., Wierling, C., ... Lehrach, H. (2005). Primary Differentiation in the Human Blastocyst: Comparative Molecular Portraits of Inner Cell Mass and Trophectoderm Cells. *Stem Cells*. 23(10), 1514–1525.

<sup>53</sup> We note that Brown disputes that the same biological individual persists from the zygote to a human adult. See Brown, M. T. (2018). The Moral Status of the Human Embryo. *The Journal of Medicine and Philosophy: A Forum for Bioethics and Philosophy of Medicine*. 43(2), 132–158.

## **CONCLUSION**

We have examined Brown's somatic definition of human organismal life, based on the somatic definition of death, and found it wanting. Diagnostic criteria for death are designed to identify sufficient conditions for determining when an organism irreversibly ceases functioning as an integrated whole. This is an empirical determination, and may vary significantly depending on how developed the organism is. Brown's definition of life is derived from a very specific definition of death for postnatal human beings, and therefore cannot be used to derive a general definition for human organismal life. Derivation of a general definition should take into consideration diagnostic criteria for death at various stages of development. Accordingly, we do not accept Brown's definition as valid. We also note that there is widespread disagreement amongst biologists and philosophers of biology about what exactly constitutes an organism due to the diversity of life; there is, however, a broad consensus that the embryo is a human organism.

We have also examined the bioethical implications of Brown's view on the status of the embryo as a human organism, and have concluded that they are minimal. Whether the embryo is classified as a human organism is of peripheral interest—a far more morally relevant question is whether the embryo is a biological *individual* with an identity that is capable of persisting during development to an adult human. On the definitions of a biological individual we have examined, it is.

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