ONLY HUMAN: PERSONHOOD AND THE NEWLY CONCEIVED

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Table of Contents

Introduction

In this thesis I will consider four criteria for human personhood that many authors argue are not met by human embryos. These criteria are as follows: 1) being a human organism, 2) being an individual entity, 3) being an independent entity, and 4) being a conscious entity. In this thesis I endeavour to demonstrate that human embryos do in fact meet these criteria at least as well as many adult humans, and thus that human embryos cannot be denied human personhood on the grounds of these criteria.

Regarding what it is to be a human organism, I explore a functionalist definition and examine the claim that human embryos do not function as human organisms, ultimately concluding that such claims are factually mistaken. Regarding the criteria of individuality, independence, and consciousness, I examine biological data that indicate that adult humans do not meet these criteria, at least at certain times, yet retain personhood in spite of failing to meet these criteria in any morally significant way. From this I conclude that individuality, independence, and consciousness are not necessary conditions for personhood.

The criteria considered are not exhaustive. Therefore, my conclusion that these criteria do not provide sufficient grounds to deny personhood to human embryos does not positively establish the personhood of human embryos. Rather, I seek to provide counterarguments against some commonly cited reasons for denying personhood to newly conceived humans.

The conclusions of this thesis are relevant to many areas of bioethical inquiry. The discussion of what elements are necessary for personhood is an important aspect of the debates regarding abortion, research involving human embryos, and criteria for the determination of death. The conclusions of this thesis regarding criteria for personhood may also influence discussions regarding the ethical treatment of some non-human animals. This text does not address these larger issues, but focuses instead on the nature of human personhood and some ways in which possession of it can and cannot be determined.

Chapter 1

Being Human

Many things are human in one sense or another. A well-preserved human corpse, for example, is easily associated with a once-living human organism and is certainly a "human" corpse, as opposed to a pig corpse. Blood used for transfusion into a human organism is clearly "human" blood. Even a handprint in plaster of Paris is readily recognized as a "human" handprint, even if there is nothing biologic about the plaster itself. None of these things, however, is a complete and living human organism. This is an important distinction to make; simply being human is not the same as being *a* human. After all, thousands of human cells may die if I inadvertently cut my arm, but though this is a kind of *sui-cide* (Latin, "self-cut") it does not carry the same significance as the conventional idea of suicide. Thus to kill *something* human is not at all equivalent with killing *a* human. This broad adjectival sense of the term 'human' is defined in the Oxford English dictionary as "of, relating to, or characteristic of humans" (Simpson, 1989).

A human *organism*, however, is a different matter altogether. Determining whether an entity is a human organism is not as easy as may seem. To do this, we must decide which criteria must be satisfied to be a human organism and whether a particular entity does in fact satisfy those criteria.

A convenient place to begin is the difference between life and death. The possession of life is a necessary condition for something to be an organism, but is not a sufficient condition, as evidenced by the fact that tissue grown in vitro does not constitute an organism but does carry on life processes. Conversely, an anatomically complete but clearly dead body is also not an organism in this primary sense of the term. In most cases it is clear whether an organism is alive or dead, but with the advent of modern technologies such as ventilator support and artificial nutrition and hydration, at times the demarcation betwixt life and death in human patients seems blurred. It is possible, for example, for a patient's lungs and heart to continue carrying out "vital" functions even if the patient is in a persistent vegetative state, but does this mean such a patient remains a human organism?

The answer to that question depends, according to neurologist James Bernat, bioethicist Robert Veatch, and many other commentators, on the state of the patient's brain. First of all, even if all brain, heart, and lung functions have ceased, that does not guarantee that every cell in a patient's body has ceased metabolic activity (Bernat 1992). Almost all of an individual's cells may still be alive immediately after decapitation, for example, and many of those cells will survive for several minutes. We would not, however, consider a decapitated individual to be alive several minutes after decapitation. This demonstrates that the lives of cells, tissues, and organs are distinguishable from the life of an organism. Even if all the cells and tissues that constitute an organism continue to carry out life processes, if they are separated and not able to carry out those functions in an integrated way for the purpose of sustaining organismal life, then the organism has died. This raises yet another question: what kind and degree of integration must tissue systems retain for organismal life to remain? Focusing specifically on human organisms, Robert Veatch argues that a patient ceases to be a living patient, and thus ceases to be a human organism, when higher brain functions are irreversibly lost (Veatch 1993). This is because certain defining characteristics of a *Homo sapiens* (thinking man), such as the ability to become conscious and engage in abstract thought, require properly functioning cerebral hemispheres. With the irreversible loss of higher brain function, Veatch argues, the life of the patient is lost, even if the life processes of the brain stem and all other organ systems continue.

Bernat, however, defends a more conservative criterion of death that requires the irreversible loss of function of the entire brain, not just the neocortex or higher brain. Bernat argues against higher brain criteria for determining death in part on the grounds that there is significant uncertainty in the ability to diagnose higher brain, or neocortical, death (Bernat 1992). Patients in persistent vegetative states, for example, vary in terms of neocortical damage from the completely "higher brain dead" to those with less extensive damage to the neocortex. Severely demented patients also suffer from neocortical damage, but this does not mean that demented patients are dead, and a few patients have had an entire cerebral hemisphere removed and continue living, with consciousness and the ability to reason (van Empelen 2004).

The above examples suggest problems with defining and diagnosing "higher brain death", but Bernat also has a more fundamental criticism of higher-brain-oriented criteria for death. Bernat argues that our definition of death should reflect the fact that death is a natural phenomenon common to all organisms, and we should not make the death of humans something unique and different from the death of other organisms, as higher-brain-oriented definitions of human death do. The only such universal conception of death, Bernat argues, is loss of the ability of an organism to function as an integrated whole. This definition applies to every organism, even though the means of functioning as an integrated whole differs between organisms. Bernat thus concludes that death in a human patient occurs only once the functioning of the brain as an integrated organ has ceased, for it is the brain as an integrated (and integrating) organ that allows the human as an integrated organism to exist.

The criteria for human organismal life and death espoused by Veatch and Bernat have implications for necessary anatomic and genetic features of the human organism. For Veatch, sections of the neocortex are particular anatomic features that must be present in a living human organism. While Bernat would not require as much of the neocortex to be present to consider a patient living, he would still require anatomic structures of the brainstem to be functioning. For Veatch as well as Bernat, in order for an organism to be a human organism it must have a genetically as well as an anatomically human brain. Though brainstem processes necessary for integrated function do not require a genetically human brainstem, Bernat would require a patient's integrated brain to be genetically human in order to consider that patient's life a human life. One way to see this is that if a patient were to have his or her brain completely removed and replaced with a computational device designed to perform all the same functions as a brain, it would not be a continuation of a human brain. If the human brain that was replaced by the computational device was destroyed, that would be considered the death of the patient for both Veatch and Bernat despite the continued functioning of other bodily systems. These thinkers would argue that the human patient died when the brain permanently ceased to function, even if some new "life" begins immediately afterward with the majority of the original patient's anatomy. For both thinkers human death is determined by the permanent loss of a brain that is human anatomically and genetically and that will allow specifically human brain functions.

Even if we substitute a computational device for an anatomically and genetically human brain, and this device is transplanted in a seamless transition in which higher brain and integrative functions do not cease, I believe that Veatch and Bernat should still consider the original patient to have died. To explain why this is the case, I will appeal to the account of genetic identity proposed by process philosopher Charles Hartshorne (Hartshorne 1972). A computational device programmed to behave in a manner similar to a human brain might be considered human in a broad sense in that it would be manufactured by humans and intended for use within a “human” body. It would not, however, be “identifiable” with a human brain, according to Hartshorne. This sense of identity is different from the strict logical sense. Any molecule is not strictly identical with itself from one moment to the next; subatomic particles will have rotated, it will be in a different spatio-temporal position, and so on. Hartshorne’s sense of identity stems instead from his claim that having an identity is a process (Hartshorne 1972). One way to understand this “identity in process” is to use the example of Zeno’s arrow paradox, in which at any specific point in time an arrow fired from a bow is not moving, yet the arrow is still identified as a moving arrow. The identity of ‘moving arrow’ is not possessed by the arrow at any time t because movement is defined as displacement over time, rendering any object motionless at any given time. Considering only one point in time, however, is similar to considering only one point in space. At any single given point in space along the arrow’s shaft no complete arrow exists; the arrow’s physical structure only exists as a totality of all its points, just as the moving arrow only exists as a totality of all its spatial and temporal points relative to other spatio-temporal points. Hartshorne takes this process notion of identity and applies it to genetics. A human at 20 years of age has likely acquired genetic mutations since the time he or she was 5 years of age, and has lost a certain percentage of his or her telomeres. Thus, he or she is not genetically identical in a strict sense to himself or herself at 5 years of age. In Hartshorne's view, however, the 5 year old and the 20 year old are simply temporally distant parts of the same genetic entity. In the case of a human brain being replaced by a computational device, therefore, Hartshorne would claim human biological identity is not preserved, and thus he would agree with Veatch and Bernat that the original human organism has died. Even though the device may function as a brain and allow for prolonged life of the other "human" organs, it does not prolong the life of the original patient, as it is not genetically identical with him or her.

Hartshorne's notion of genetic identity helps to explain how the human brain retains its identity through time despite genetic changes, and thus also provides an account of the survival of the human organism that depends on that human brain. It may, however, encounter problems in determining whether a body as a whole is a human organism. Consider a woman whose kidneys have failed and who receives a kidney transplant from a dead human donor. The donated kidney no longer functions to sustain life processes for its original body, so despite the kidney continuing to function, the donor as a human organism is dead (provided the donor's brain has ceased to function). The case of the recipient is slightly less straightforward. The recipient's brain continues to function and so the recipient has not died, according to Veatch and Bernat; however, the recipient is not entirely genetically identical with herself pre-implantation. That is to say, the majority of the cells in her body are identifiable with their past instantiations. The kidney, however, according to Hartshorne's process account, is genetically identifiable with its past instantiations in the body of the donor. The recipient is thus not completely genetically identical with any past human, for some cells are identical with her body in the past, and some are not. If the recipient immediately after the operation is not completely genetically identical with any past human, has she lost her identity as a human organism? To make sense of the kidney recipient's identity we must apply Hartshorne's process account of identity to anatomy as well as genetics. A human organism from one day to the next is not only genetically identical, but also anatomically identical in a process sense. Cells are continuously dying and being replaced, causing microscopic anatomical changes, but the anatomic identity of a human organism is the continuous process of these anatomic changes over time, so long as the essential functions of the organs and of the organism as a whole persist over time. If I were to have a leg amputated I would not after that be strictly identical anatomically or functionally to myself at present, but by Hartshorne's process account of identity I would be anatomically derived from my past self and would retain essential functions. Thus, I would remain the same organism over time. Despite being less adept at walking I would retain my functional identity; that is, I would be capable of carrying out necessary functions that would support integrated brain functions and would thus function as a human organism. Such "minor" anatomic alterations do not deprive me of my identity as a human organism, just as accruing mutations over the course of my life does not deprive me of my identity genetically so long as those mutations are not severe enough to cause me to cease functioning as a human organism, i.e. through causing human brain death. According to Hartshorne's process account of identity, then, the kidney recipient is only mostly identical with her past self genetically yet she remains the same organism, because her body retains the ability to sustain human life through biologic processes that keep her brain functioning in a human way.

If this account is correct, the continuing existence of a human organism does not require absolute genetic or anatomic identity. What is required is a high level of functional continuity over time. What this appears to mean is that the identity of a human organism does not rely entirely on genetics or anatomy. Rather, the continuity of essential brain processes, with their underlying anatomical and genetic foundations, is essential. Genetic, anatomic, and functional process identity are all required for a human brain to continue living, which in turn is required for a human organism to continue living. For other organ systems, however, only functional identity need be retained for the organism as a whole to retain the identity of a human organism. This is because a human organism can continue to live after an organ or organ system (other than the brain) has ceased to carry on life processes, so long as the essential functions of that organ or organ system are performed by a surrogate.

What is essential, then, for human organs or their surrogates is that they perform those functions that enable the continued function of a human brain as an integrated organ. For example, if xenotransplantation were a perfect science, a human-derived kidney could be transplanted into a pig. Since genetic and anatomic identity are not necessary for the continuation of a biologic identity, the pig has not ceased to be a pig merely because of the introduction of a “human” kidney. Once the kidney performs its functions for the purpose of sustaining the life processes of a pig, rather than the life processes of a human, it becomes functionally identical with a pig kidney. To reverse the example, a pig-derived kidney implanted into a human body will perform its kidney processes to sustain the function of a human brain as an integrated organ and will thus be functionally identical with a human kidney. In this way a particular human patient can receive a donated organ from another human, or from any other organism, and remain the same human organism because only functional identity is necessary in all parts save the brain, which appears to require genetic and anatomic identity in addition to functional identity in order for the life of the specified human organism to continue. In other words, a kidney may be lost or gained without a patient ever ceasing to be him or her self, but if the patient's brain is lost, then the organism has died.

One interesting question is whether a patient retains his or her identity as a human organism if necessary bodily functions are being performed by a machine. In the kidney transplant example it is possible that the patient would have been on dialysis for some time before receiving her new kidney. The dialysis machine would have performed functions necessary to sustain a human brain as an integrated organ, but it would not have done so through traditionally biological means. In this way the system as a whole would not have been strictly an organism any more than it would have been strictly a machine. It might be claimed that a human patient on dialysis is a human mechanism rather than a human organism, for such a system functions *mechanistically* to support the processes of a human brain, but does not function *biologically* to do so. If this were the case, then the patient would have lost her identity as a human organism, albeit temporarily, and the human organism she becomes after the transplant would not be not identifiable with her human organismal self before the transplant. To say that her pre- and post-implant selves are not strictly identical is certainly true, but that does not require the conclusion that they are not biologically identifiable with one another. After all, the integrated brain processes of the patient were able to continue, and the integrated biological processes of every organ of the patient besides the kidneys have also continued, and so the pre- and post-implant patients are in fact biologically identical in a process sense. For this reason it is necessary to adopt a strictly functional definition of all human organ systems save the brain. Thus, not only do the systems that support the patient's brain processes not require a genetic or anatomic identity in common with past states of the patient's body, they do not require a biologic identity at all in and of themselves.

Nor is it necessary that a human brain or organ system be *currently* sustaining specifically human brain functions, such as consciousness and abstract thought. A sleeping or anesthetized patient lacks consciousness, but consciousness may eventually be regained. There have been cases of patients in comas or in vegetative states, with minimal neocortical function, who have nevertheless regained consciousness at a later time (Andrews 1993). Did their brains cease to be human brains during this time, and did their organ systems cease to be human organ systems? Such a claim would be counterintuitive, and Hartshorne would posit that the sleeping patient is still identical with his or her past conscious self in a process sense, and will still be so upon waking. Veatch and Bernat both argue that such a patient is not dead until brain function is lost *irreversibly*, which means that the human organism is alive until such time. What this means is that a patient's brain can fail to function as an integrated organ *presently* capable of consciousness and abstract thought, without ceasing to be a human brain, and the other organ systems of the patient's body therefore do not cease functioning as human systems even though they are not currently sustaining conscious human brain functions. A human organ, then, is a system which functions in such a way as to currently or eventually allow a human brain to function. A human organism, it follows, is any integrated system which allows or will eventually allow higher brain processes to occur in a brain that is genetically and functionally human.

One term, ‘genetically human’, needs additional clarification. The genome of a specific human organism cannot be fully understood by comparison to a “standard” human genome. In fact, there is no such human genome “standard,” as genotypic diversity is very high in human organisms. Though the human genome map completed by the Human Genome Project has described the genome of the average human organism, some human organisms have kareotypes that are significantly different from most members of the species. Klinefelter syndrome and trisomy-21 patients, for example, have an extra chromosome, and Turner syndrome patients are missing a significant portion of a chromosome, yet these patients are able to live relatively normal lives and carry on higher brain functions. Since every cell in the body inherits these chromosomal additions and deletions, the brain cells of such patients are as genetically dissimilar from “normal” human cells as any other cell in their bodies. However, just as genetic, anatomic, and biologic identities are not essential for an organ to be a human organ functionally, having a “complete” set of human chromosomes is not essential for a genome to be a human genome functionally. The reason for this is that each cell in a human body has specific tasks to perform, and each task does not require all of the information within the genome. A liver cell needs to perform specific functions that are different from those performed by pancreatic cells; both the liver and pancreatic cells have the full inherited genome of the organism within their nuclei, but certain sections of the genome control the functions of liver cells, and other sections of the genome control the functions of pancreatic cells. The genes the liver cell does not use are "switched off," making the cell function as if those genes were not present at all. This means that the liver as a whole not only functions differently from the pancreas, but also functions differently *genetically* as well as chemically and mechanically. If a human brain must possess a human identity genetically, this does not entail that it possess an entire human genome but simply that it must perform necessary human integrated brain functions according to the instructions contained within human genetic sequences that control those brain functions. Those genetic sequences are only human genetic sequences insofar as they will naturally result in an organ that performs integrated brain functions that will in turn naturally result in particularly human higher brain processes. This seems like circular logic; a brain is human if it is human genetically, and genes are human if they will result in a human brain. The circle is broken by realizing that a human brain requires not only human genetic identity but also the ability to perform uniquely human mental functions, such as imagination and complex rational thought. The important thing to note here is that being genetically human is a matter of functionalism rather than possessing or inheriting specific genes, and so we may revise the definition of a human organism: any integrated system which will or does allow higher brain processes to occur in a brain that is functionally human.

We can now consider whether a human embryo immediately after conception satisfies the above definition of a human organism. The human embryo is an integrated system, in that it is a specific and unique group of cells that are connected, and it is one that will, in the normal course of human gestation, eventually allow higher brain processes to occur in a brain that is functionally human. It is important to note that actually attaining higher brain functions in the future is irrelevant to a system being a human organism at any given time; as Hartshorne notes, the past and present instantiations of an identity may affect the identity's future states, but future states cannot affect their predecessors. For example, a patient in a vegetative state may regain higher brain functions eventually, if the patient receives continuing life-sustaining treatment and no additional complications or other disease or injury intervenes to end the patient's life. If such a patient died without regaining consciousness, we would say that a human organism had died even though the potential for eventual higher brain processes had never been fulfilled. Similarly, a viable human embryo that fails to implant will never develop into a system that will sustain higher brain function, but it is a system which could develop higher brain function eventually and naturally, according to instructions contained within a functionally human genome, but did not receive the opportunity to do so. As such, when a viable human embryo fails to implant and is expelled, it is the death of a human organism. There are, however, exceptions that are worth mentioning. In the case of a lethal mutation to the genome or a lethal error in meiosis, the genome possessed by the "embryo" is not functionally a human genome because it does not carry the necessary genetic information to sustain life processes that will result in human brain function. The death of an "embryo" carrying such a deleterious mutation would be akin to the death of human tissue, i.e. a group of cells that carry specifically human genetic sequences but that can never function as a human organism.

It has been claimed by some philosophers that human embryos do not actually perform all the functions necessary for their survival and development (Bedate 1989, Effron 2005). If it is true that a human embryo does not perform necessary functions to sustain its survival, then it would also be true that a human embryo is not a human organism. These philosophers argue that it is the body of the embryo's mother that, for example, provides nutrients to the embryo. The arguments regarding an embryo's dependence on its mother will be examined in greater detail in chapter 3, but for now it will be useful to examine some ways in which the embryo actively functions to sustain its own life processes.

After implantation in the endometrium, the embryo excretes chemicals that alter the physiology and biochemistry of its mother in important ways. The arterioles that supply blood to the endometrium, and thus to the placenta of the embryo, are known as spiral arteries. One effect of the embryo's chemical signals is to

> remodel the endometrial spiral arteries into low-resistance vessels that are unable to constrict. [...] Therefore, a mother cannot reduce the nutrient content of blood reaching the placenta without reducing the nutrient supply to her own tissues. Second, the volume of blood reaching the placenta becomes largely independent of control by the local maternal vasculature (Haig 1993).

The embryo also excretes human placental lactogen, a chemical that increases maternal resistance to insulin (Haig 1993). The effect of this chemical is to cause blood glucose levels of the mother to increase, and to remain higher for longer, after meals. Since the mother's body cannot reduce blood flow to the embryo, this results in increased blood glucose available to the embryo. These examples demonstrate that a human embryo does not passively receive materials necessary for its survival, but actively acquires them. The human embryo does, then, carry out functions necessary for its survival and thus functions as a human organism.

In terms of anatomy an embryo is vastly different from an adult, possessing no brain or organs immediately after conception. Even genetically a human embryo is significantly different from an adult, as an embryo is initially entirely composed of stem cells, with particular genetic sequences activated that will never be utilized in adult life and other sequences deactivated that will be functionally necessary in adult life. Despite its undeveloped state, however, an embryo is a human organism functionally. Its anatomy and genetics function in a way that sustains human life processes, and those functions will eventually (in the normal human gestational process) allow the development of a functioning human brain. The embryo is thus easily distinguishable from human tissue in vitro, which might be very similar anatomically and genetically in physical terms, because the human tissue does not *function* in an anatomically and genetically human way, i.e. by performing processes to sustain human life that will eventually result in a functional human brain. The embryo is a human organism, but human cells in culture are not, for the same reason that a conscious human is a human organism but a brain dead patient is not.

Chapter 2

The Myth of Individuality

In this chapter I will explore the relationship of individuality to personhood. Several thinkers have asserted that individuality is a necessary condition for personhood. These thinkers conclude that personhood should be denied to embryos if it can be shown that they are not individuals. Exactly what is meant by 'individual' is not clearly or specifically defined by these thinkers, but there are two senses of 'individual' of primary importance to their arguments. The first is what I will call indivisibility of body or anatomic structure, and the second is indivisibility of mind or consciousness. After explaining the basic reasons offered for the claim that embryos lack individuality, both in terms of physical and mental structure, I will provide evidence that adult human organisms lack individuality to the same extent as embryos. I will conclude from this that individuality is not a necessary condition for personhood, and that embryos cannot be denied personhood solely on the grounds of lacking individuality.

At the outset, it will be helpful to review basic embryology, as embryologic evidence is used by several of the philosophers discussed in this chapter to make their claims. In the human organism the embryonic stage is the stage from conception until about the ninth week after conception, at which point the developing organism is called the fetus (Larsen 2001). In all other organisms the developmental stages from conception until birth are all termed embryonic stages; only for humans, and only for reasons of convenience and keeping with tradition, is the fetus distinguished from the embryo. In this discussion I will refer only to the early stages of the embryo, i.e. the embryo from the moment of conception until shortly after implantation in the endometrium. Some of the authors quoted will refer to different stages of development of the early embryo, such as the conceptus, blastocyst, morula, or embryonic disc. These terms all refer to the early embryo, but at slightly different (and somewhat arbitrarily defined) stages of development (Larsen 2001).

Of primary importance for this discussion is the totipotency of embryonic cells. That is, all the cells of an early embryo are stem cells capable of developing into the full range of "adult" human cells; i.e., any given cell in a 16-celled early embryo could ultimately develop into a liver cell, brain cell, skin cell, and so on. At the appearance of the primitive streak, about 14 days after conception, however, genetic restriction occurs. After this point the embryonic cells are still capable of becoming a wide range of cell types, but any given stem cell can only become one of a particular set of cell types. In some embryonic cells, for example, the genes required to develop into liver and heart cells may be turned off at genetic restriction, but the ability to develop into either a part of the brain, spinal cord, or peripheral nervous system remains. At this point the cells are pluripotent, because they can develop into many cell types, but no longer totipotent, because they cannot develop into all cell types (Larsen 2001). Before genetic restriction any given embryonic cell could be separated from the rest of the embryo and develop on its own into a complete human organism, because it is fully totipotent (this is how identical twins come to be). The developmental stage of interest for this discussion is the stage from conception until genetic restriction. As we will see, it is during this stage that the individuality of the embryo is questionable.

The first sense of individuality I will examine is physical indivisibility. There are two ways that embryos are viewed as being physically divisible. The first way, espoused by philosophers such as Carson Strong, Stephen Buckle, Karen Dawson, and Peter Singer, is purely anatomical in nature (Buckle 1988, Buckle 1989, Strong 1997). The second way, espoused by philosophers such as Thomas Shannon, A. B. Wolter, and Thomas Milby, is more genetic in nature and will lead us to considerations of mental divisibility (Milby 1983, Shannon 1990).

First we will consider the purely anatomical approach to claiming that embryos are not individuals. Strong writes regarding human embryonic development:

> As cell division proceeds following fertilization, cells begin to differentiate in order to carry out a range of functions. Some cells and their descendents create the placenta, while others form the yolk sac, others amnion, and so forth. It is only in a subset of cells, the 'embryonic disc', that the so-called 'primitive streak' appears, marking the beginning of the embryo proper. The embryo is distinct from the other life support structures such as the placenta, amnion, and chorion (Strong 1997).

Strong uses this claim as evidence that the preimplantation embryo is not biologically identical with an adult human organism, because not all the cell lines derived from the preimplantation embryo will be part of the adult's body. Adult humans do not have placentas attached to their bodies via umbilical cords, and so Strong holds that any cell line that develops into a placenta or umbilical cord is not part of the spatio-temporal entity that is a human organism.

Buckle, Dawson, and Singer agree that "a new human individual does not come to exist until the formation of that discrete biological entity which will itself develop into the human foetus" (Buckle 1988, Buckle 1989). For Buckle et al., the fetus is identical with the adult human into which it develops. Recall that this is in line with the process account of biological identity discussed in chapter one.

If the early embryo is not identical to the fetus or adult human, then what is the relationship between these entities? Strong attempts to answer this question by distinguishing between two senses of potential: potential to *become* and potential to *produce*. The potential to become, according to Strong, is "the potential possessed by an entity to undergo changes which are changes to itself" (Strong 1997). The potential to produce does not require any such preservation of identity. Strong uses the example of a gaseous mixture containing hydrogen and oxygen (but not water vapor). Such a mixture has the potential to give rise to water under appropriate conditions. If water is produced, however, the water will not be identical to the gaseous mixture. The gaseous mixture does not have the potential to become water, only to the potential to produce water. Strong compares this to a Petri dish containing a human ovum and human semen. Under appropriate conditions it is possible for this mixture to produce an embryo, but the embryo would not be identical with the mixture of egg and sperm. Because not every cell of an early embryo will become part of the "embryo proper", Strong claims that "although the preembryo has the potential *to produce* a self-conscious entity, it lacks the potential *to become* a self-conscious individual" (Strong 1997). There are two fatal flaws with this approach.

The first flaw is the claim that structures such as the placenta are not actually parts of the body of the embryo. This mistake stems, I believe, from a conditioned response. Normally when we see a human organism it has one head, two arms, two legs, a torso, no placenta, and so on. For this reason when seeing a fetus or embryo, complete with amniotic sac, placenta, and umbilical cord, many observers tend to think that the entity with the head, arms and legs is the fetus, and everything else is just connected to the fetus. Although this is the conventional view, there are good biological reasons for rejecting it. As discussed in chapter one, a structure is an anatomic part of an organism if it fills the functional role of that anatomic part. During gestation, the placenta serves the function of gas exchange while the lungs develop (Larsen 2001). There is no distinct section in the umbilicus ("belly button"), along the umbilical cord, or in the placenta where there is any discontinuity between the tissues of the "embryo proper" and the placenta. Similarly, the amnion is a sac that surrounds the "embryo proper" creating an internal environment that is conducive to development and protecting the "embryo proper" from external environmental changes. The amnion thus serves the functional role of the integumentary system (skin and hair) of an adult human organism while the skin of the embryo and fetus develops (Larsen 2001).

The natural conclusion to be drawn from this is that the placenta and amnion, and every other cell that developed from the embryo and serves a biologically important function for the embryo, is in fact part of the embryo. All of these parts of the embryo's body help it to develop into the self-conscious entity that it will eventually become. Neither the amnion nor the heart or lungs develop into a self-conscious entity. Rather, they are functional parts of an organism that will develop into a self-conscious being (in the normal course of gestation). These organs are not themselves conscious, but they assist in the development of an entity that can become conscious. The placenta and amniotic sac are just as much a part of an embryo as any other cellular structure. Thus Strong's claim that "the embryo is distinct from the other life support structures such as the placenta, amnion, and chorion" is incorrect embryologically; there is no boundary separating the placenta from the "embryo proper" (Strong 1997).

The second flaw is the claim that an anatomical structure such as the placenta is not a part of the embryo because it is only a temporary structure. Let us consider the counterexample of deciduous teeth ("baby teeth"). Deciduous teeth develop before birth in humans (West 1926). For some years after birth deciduous teeth perform the biologically important function of mastication (chewing). Eventually the deciduous teeth are replaced by permanent teeth, and cease to be a part of the body of the human organism that once made use of them. If Strong's argument that temporary structures are not part of an organism is correct, then deciduous teeth are not actually a part of that person's body, because they only serve a temporary role that is not essential for self-consciousness (because self-consciousness could arise without the presence of deciduous teeth, and deciduous teeth can exist without self-consciousness, i.e. during gestation). This would also be true of hair, skin cells, liver cells, and any other cell, tissue, or organ that is lost or replaced during the life of a human organism. If possessing a biological structure temporarily is grounds for saying that it is not a part of one's body, then an amputated limb is not part of the spatio-temporal biological entity that is the body of the amputee.

Any cell, tissue, or organ that serves a biologically functional role is part of the body of the organism for which it serves that function. Recall the process account of biological identity: any cell of an organism that performs a biological function for that organism is a part of that organism biologically. Because of this, an early embryo has not only the potential to produce an adult human organism, but the potential to become an adult, because the potential to become is "the potential possessed by an entity to undergo changes which are changes to itself" (Strong 1997).

Strong, Buckle, Singer, and Dawson argue that an early embryo is not an individual because the early embryo does not, as a whole, develop into an adult human, i.e. that the early embryo is anatomically divisible (Buckle 1988, Buckle 1989, Strong 1997). I have argued that this conclusion is incorrect. Now I turn to arguments that the early embryo lacks individuality because it may develop into more than one adult human organism.

The anatomic divisibility argument is closely linked to the argument that an embryo may become more than one "individual" adult human. The latter argument is different in that it is concerned with the fact that a single embryo before genetic restriction can split into more than one embryo and develop into more than one self-conscious entity. I will turn now to this argument concerning multiple entities.

Twinning is the term used when a single embryo splits into more than one viable embryo (Milki 2002). It is also possible for more than one embryo to fuse together to form a genetic chimera, though this is "rarely described in humans" (Simon-Bouy 2003). Shannon and Wolter write that

> After restriction, at around three weeks, totipotency is “turned off” and the preimplantation embryo becomes indivisible. Because the preimplantation embryo is not an individual during this time, it cannot be a person. Individuality is a necessary, though not sufficient condition of personhood. [...] It is difficult, if not impossible, to argue that the preimplantation embryo is a person because it lacks individuality (Shannon 1990).

Thus, the important fact for Shannon and Wolter is that a single embryo will not necessarily develop into a single adult human. Since all adult humans are thought to have personhood, they claim that personhood cannot be ascribed to embryos because no embryo is necessarily identical with a single adult human. Milby agrees with this line of reasoning by referring to the possibility of human chimerism (Milby 1983). He writes that

> Although chimeric people arise from two separate fertilized eggs, with the resulting amalgam of physical characteristics, they are not two separate people merged into one. A chimeric individual is a whole integrated person of the kind produced by a zygote developing along a normal developmental pathway. Thus the essential personhood of the chimera is neither altered nor enhanced by the duality of its zygotic origin. [...] a chimera may be produced by the fusion of two or more morulas at an early stage in their development. Each of those morulas could have developed independently into a human being. Each had the potential to become a separate person. Yet when two or more morulas fused into a single entity, they gave rise to only one single person (Milby 1983).

Shannon, Wolter, and Milby are referring in one sense to anatomic individuality. Of course, any adult human organism can lose current anatomic structures or gain new ones, by amputation or organ donation for example. The more important aspect of the possibilities of twinning and chimerism is that two twins will develop into two separate conscious human organisms, and one organism will result from the fusion of two early embryos. The fact that the embryos separate anatomically is less important for this line of argument.

The ability to develop into more than one conscious entity is not unique to early embryos, however. In fact, divisibility of consciousness seems to be possessed by all human organisms and persons, rather than preventing personhood. This will take some significant explanation because at first glance it appears completely implausible that an adult human is divisible consciously. We will turn to such an explanation now.

More than a few philosophers, among them Derek Parfit and Roland Puccetti, have examined the cases of "split-brain" patients (Parfit 1987, Puccetti 1973). Such patients can be artificially created by surgical means. A commissurotomy is a surgical procedure in which the tissues connecting the left and right hemispheres of a human's brain, most notably the corpus callosum, are severed to prevent the spread of brain seizures or lesions (Ouimet 2009). It is also possible to perform a hemispherectomy on a human brain, in which one cerebral hemisphere is excised (Liégeois 2008). There are even cases of naturally occurring split-brain patients, where the corpus callosum and other tissues that typically connect the human brain hemispheres do not develop normally (Lewis 1988).

Because commissurotomy patients retain both hemispheres after surgical intervention, and because their brains are "normal" apart from the lesions or seizures that gave cause for the surgery, Parfit and Puccetti focus on this particular type of split-brain patient. Two interesting aspects of mammalian brains, and human brains in particular, should be reviewed to provide background for these arguments. The first is contralateral hemispheric input/control. The right hemisphere is dominant in terms of motor control over the left side of the body and face, and the left hemisphere controls the right side of the body; this is contralateral control. The right hemisphere also receives sensory input from the left eye, left ear, the left peripheral nerves, and so on (Cramer 1999). Olfaction (smell) is the only sense that is ipsilateral, i.e. a smell introduced to the right nostril will be detected by the right hemispheric olfactory nerves. The second interesting feature of human brains is that *Homo sapiens* is one of the few species known to have a dominant brain hemisphere. Ninety-six percent of right handed humans are left-hemisphere dominant. Seventy-six percent of left handed humans are also left-hemisphere dominant (Pujol 1999). The centers for language recognition and speech control are nearly always in the left hemisphere, which is the most likely explanation for the dominance of the left hemisphere among such a verbose species (Pujol 1999).

This particular aspect of the human brain enables us to recognize that the human brain possesses more than one conscious awareness. In the words of Puccetti, "It is customary to think of a human being as having a single brain, possessing a unitary mind, constituting a unique individual person. However recent studies [...] suggest a very different state of affairs" (Puccetti 1973).

Both Parfit and Puccetti note in their work the peculiar results of studies conducted with split-brain patients. Parfit describes an experiment in which the left eye of a split-brain patient is shown a screen of one color, and the right eye is shown a screen of a different color. When asked to write what color is seen, the right hand will write one color while the left hand writes (much more poorly, since the right brain does not contain the language center) a different color (Parfit 1987). When asked how many colors the patient can see, he or she responds that only one color is seen. This is because the left brain is aware of seeing only one color, and is in control of speech production.

Another result of split-brain patient studies suggests that even though each hemisphere may be self-aware, the hemispheres are not always aware of one another; this is important for understanding why most humans do not think their craniums contain more than one conscious entity. If, for example, a question is shown to the left eye, and thus perceived by the right hemisphere, the left hand can answer the question non-verbally, i.e. by selecting an appropriate item from a box or writing down an appropriate response. When a patient in this situation is "asked how he was able to do that, he replies that he does not know, or confabulates" because the left brain is unaware of the question, though it is aware of hearing from the examiner that the answer was correct (Puccetti 1973).

The left hemisphere is easily seen to be self-aware, because it can report such things as recognizing the patient's face in a mirror, and can explain the logical steps behind answering a question. The right hemisphere, or what Puccetti calls the "mute" hemisphere, has no speech center (in most patients) and thus cannot tell us what it thinks of itself, if it thinks of itself at all. It may seem that the right hemisphere is nothing more than a computational device that is used by the dominant left hemisphere; Puccetti does not think so, however.

Observations indicate two things that confirm that the right hemisphere is consciously aware: the right hemisphere is capable of complex rational thought, and the right hemisphere, at least in some patients under certain circumstances, can become aware of the left hemisphere. Puccetti reports that in tests where "the right hemisphere has had, say, a key presented to it visually and the patient is asked what he has seen, the speech hemisphere often guesses while the subject's head nods negatively at each wrong guess, or frowns disapprovingly" (Puccetti 1973). This suggests that the right brain is hearing the guesses of the left brain, recognizes them as inappropriate, and responds of its own volition. In other tests, the right hemisphere is shown an item and asked to point to the picture that matches. When shown a watch, the left hand chooses the picture of a wall clock; when shown the words "utensil for cutting" the left hand chooses the picture of a knife, and so on. "The minor hemisphere, then, does have language comprehension and at least a rudimentary verbal conceptual scheme; it is simply unable to utilise these for speech production or writing" (Puccetti 1973). It may not be possible to show that the right hemisphere is self-aware, but it is clear that it is at least sometimes aware of its cerebral complement and it is capable of complex thought, symbolism, and language. In the words of Puccetti, "what we have here, then, is an apparent doubling of conscious awareness, with independent cognitive and volitional processes at work in the same body" (Puccetti 1973).

The evidence of split-brain patients seems to indicate that there are at least two conscious entities within any normal adult human organism. One argument against this is that a human brain has only one conscious experience before commissurotomy, and that this conscious awareness is divided by the unnatural surgical procedure. In such a view one might say that two individual consciousnesses exist within a single human cranium in the case of a split-brain patient, but not in a "normal" patient.

Puccetti offers the following evidence against such a view: split-brain patients never complain about the loss of half of their visual field. In fact, a split-brain patient "seems not to notice this loss; indeed he does not respond to an appropriate question about the difference from the examiner" (Puccetti 1973). Puccetti explains the reason for this:

> When someone has a lesion in the peripheral visual system [...] he notices a hole in his visual field because he retains memory of that area being filled with visual stimuli that no longer come in. However when the [hole in vision] is due to a lesion in the visual cortex itself, there is no sense of loss because all memories associated with it are gone too (Puccetti 1973).

The reason the left, speaking hemisphere never complains about the loss of half of its visual field is because it has not lost half of its visual field. The left side of the occipital lobe (responsible for visual experience) has no memory of what was seen by the left eye, and has never experienced what was seen by the left eye. Every conscious experience of sight had by the left eye was never experienced by the left brain. In the words of Puccetti, "it is only because we persist in thinking of these two brains as sharing a single visual field that we misleadingly call their visual fields half fields" (Puccetti 1973). The truth is that the left brain has never received any information from the left eye; it does not miss the left eye's visual field because it was never directly consciously aware that there was a left eye visual field. The left brain only ever received information about what was seen by the left eye indirectly from the right brain.

Now we must turn back to the question of individuality. Clearly an adult human organism is not mentally indivisible; commissurotomy and hemispherectomy surgeries have proved that certain memories and cognitive abilities can be removed or separated without destroying the patient's brain or depriving the patient of the ability to reason. The evidence presented by Puccetti indicates that not only is it surgically *possible* to separate conscious experiences, but that they are in actuality always separate in a "normal" human brain. It only appears that we have one conscious experience because both hemispheres of our brains receive almost identical visual, auditory, tactile, olfactory, and all other types of input. Not only that, but because of the corpus callosum and other connective tissues our (at least) two separate consciousnesses are able to share information with one another frequently and nearly instantaneously.

There is yet more evidence explaining why our brains are not typically aware of having more than one conscious experience. Puccetti writes that

> in the split brain patient each hemisphere is usually able to exert its control over the whole motor system. Thus for example a triangle projected into the right half brain can be

> drawn by the patient's right hand provided the left, dominant hemisphere does not see another figure, say a square, at the same time (Puccetti 1973).

This is also true of a patient with a "normal" brain. When input requires writing or speaking an answer, the left brain assumes control of the whole motor system of the body because the right brain has no reason to override the left brain's control. This might also be the reason for an artist's inability to explain the creative process; when inspiration "takes over" it may simply be the right hemisphere, which is more attuned to spatio-visual representations, musical tones, and other artistic aspects, assuming control of the body's motor system.

Puccetti's conclusion from these data is as follows:

> Both brains, as we have seen, were conscious and functioning in their rather specialised ways before the operation. [...] Thus even in the normal, cerebrally intact human being there must be two persons, though before the era of commissurotomy experiments we had no way of knowing this (Puccetti 1973).

The claim that there are always two persons present in every “normal” adult human is a strong one. Whether this is actually the case or not, Puccetti’s arguments do indicate that there is more than one conscious entity within any given “normal” adult human, and that these conscious entities are separable. The question of whether this constitutes multiple persons in a single human organism is a question beyond the scope of this thesis. For this text it will suffice to recognize that any given adult human is at least one person, and the conscious experiences of that adult are divisible.

It is also interesting to consider a patient with a particular lobe of the brain separated from the rest, but not from its specific sensory input neurons. The temporal lobe, for example, is responsible for hearing; suppose one of a human's temporal lobes were to be disconnected from the rest of the brain, but remained connected to the contralateral functioning ear. The ear would still function, and would still send information along nervous pathways to the temporal lobe. Would the temporal lobe still hear? If so, would we say that the temporal lobe has a conscious experience of sound? I am inclined to believe that every significantly complex section of brain, such as each lobe, has its own consciousness that, to use Parfit's terminology, is "bundled together" with all the other conscious experiences but does not need to be in order to be conscious itself (Parfit 1987). Currently there is no data to support such a claim, but I do not find it to be terribly far-fetched.

From these observations it is clear that no human is indivisible mentally. Any human, at any age, could develop into more than one conscious entity via commissurotomy. It is likely, according to Puccetti and Parfit, that all humans are actually more than one conscious entity already, but they are simply unaware of it.

In this chapter we have explored arguments from individuality, specifically individuality as indivisibility of anatomy and indivisibility of consciousness. It is clear, by examining such events as organ donation, loss of deciduous teeth, and amputation, that human organisms do not at any stage of life possess indivisibility of anatomy. It is also clear that merely losing a body part does not mean that it is not a part of the entire spatio-temporal organism in a biological sense. From cases of commissurotomy and hemispherectomy it is demonstrable that human organisms do not at any stage of life possess indivisibility of consciousness. Thus, if indivisibility of body or of mind is necessary for individuality, adult humans lack individuality. Adult humans do not, however, lack personhood as a result of this lack of individuality. Because this is the case, embryos should also not be denied personhood on the grounds that they lack individuality. The fact that an embryo may develop into more than one conscious biological entity is not grounds for denying personhood; any fetus, neonate, child, or adult will, in the natural course of biological development, develop into more than one conscious biological entity. Several writers have attempted to deny that embryos are persons on the basis of individuality. According to the definitions of "individual" put forth by these writers, however, an embryo at any stage of development is just as much (or as little) an individual as any adult human.

Chapter 3

The Insignificance of Independence

In this chapter I will examine the nature of dependency and its relationship to personhood. Some scholars claim that the human embryo is entirely dependent on and a part of its mother's body. Because of the special kind of dependence an embryo has on its mother, these thinkers conclude that personhood should be denied to the embryo. After discussing different meanings of the term 'dependence', I will provide evidence that the dependence of an embryo on its mother is not different in kind from the various types of dependence adult humans experience throughout life. From this, I will conclude that personhood cannot be denied to embryos solely on the basis of being dependent entities.

First, it needs to be established precisely what is meant by 'dependent'. All human organisms depend on other organisms and even non-organic matter for survival; we must consume other organisms for nutrition and breathe oxygen to utilize that nutrition. Some humans, such as the elderly and very young, depend to a greater degree than others on assistance from other humans. Robin Jane Effron provides some useful distinctions among different types of dependence that she believes are morally significant (Effron 2005). Effron divides dependence into three types: general dependence, material dependence, and physical dependence.

General dependence is characterized by its nonspecificity (Effron 2005). As an example, all adult humans are generally dependent on other organisms for nutrition. However, an adult human in need of sustenance can consume vegetables or fruits or meats or a combination of the three, and so forth, to get the nutrition necessary for survival. Unlike the other two types of dependence, there is no special relationship between one who is generally dependent and any particular source of necessary materials.

Material dependence is characterized by the interchangeability of providers of a particular necessity. Effron uses the example of a critically ill patient who depends on the assistance of healthcare professionals (Effron 2005). This is more specific than general dependence; not just anyone can help the patient, because only physicians, nurses, and so on are capable of providing the needed assistance. As Effron points out, however, "the particular identity of the caregiver is unimportant" (Effron 2005). It does not matter which specific nurse administers to the patient, so long as the nurse has the proper training.

Physical dependence is characterized by its direct reliance on a single source of support. According to Effron, "[s]ome beings that are alive owe their continued existence to complete dependence upon a physical attachment to a unique other. The paradigmatic example is the nonviable fetus" (Effron 2005). A fetus is physically dependent, according to Effron, because it is attached to its mother and cannot be transferred to any other before viability without dying. Effron's claim is that the fetus is not dependent on adult humans in general, nor is it materially dependent on a specific type of adult human, but it is physically dependent on the adult human to which it is attached. Effron writes that

> […] even the materially dependent being can be transferred, as a separate and bounded person, from one attachment to another. The physically dependent being, however, cannot be transferred as a separate and bounded person and its identity is thus not only linked to the other to which it is attached, but it seems to have no identity of its own at all (Effron 2005).

For Effron, physical dependence is sufficient grounds for denying personhood. One implication of physical dependence that is particularly important for her is not the dependence per se, but the fact that a physically dependent being seems to be a part of another biologically. In Effron's words, "[i]t becomes clear that beings that exhibit a very specific sort of dependence are not persons [...] The fetus lacks personhood because, in addition to being dependent on another, it is part of another" (Effron 2005). Effron does not clearly differentiate between the relationships "being physically dependent on" and "being a part of". In the case of the implanted embryo, according to Effron, it seems that both relationships are present and that it is because the embryo is part of the mother that it is also physically dependent on her. Carlos Bedate and Robert Cefalo agree that developing humans are not persons because "the blastocyst is established in the uterus with absolute physiological dependence on the mother [...] the status of the zygote cannot be the same as that of the person it will become" (Bedate 1989).

These authors argue that the fetus is physically dependent on the pregnant woman, and that such a dependent relationship is sufficient to deny personal moral status to the implanted embryo. There are, however, strong grounds for rejecting the factual premise that the fetus is part of the pregnant woman. I will turn now to providing embryological evidence to show that there is no point in time, from conception to birth, at which an embryo is a part of its mother's body. I will then examine the implications of these data for the idea of physical dependence and how it might relate to personhood.

It will be helpful for this endeavour to give a brief overview of the embryo's relation to the mother's body from just before conception until just after birth. An ovum is released from a woman's ovary and travels into the fallopian tube once per month in normal, fertile women (Larsen 2001). In cases of pregnancy, the spermatozoa encounter the ovum in the fallopian tube; typically one spermatozoon penetrates the clear glycoprotein membrane that surrounds the ovum, called the zona pellucida (Behr 1999, Larsen 2001). After conception, the embryo continues to drift through the fallopian tube and eventually arrives in the uterus. Just before implanting in the endometrium (lining of the uterus), the embryo hatches from the zona pellucida (Behr 1999, Larsen 2001). The embryo then develops a placenta which anchors itself to the endometrium. The mother's blood supply never encounters the blood supply of the embryo. After implantation there is a separation between the mother's and embryo's blood vessels, called the intervillous space (Hempstock 2004, Larsen 2001). The embryo continues to grow and develop, with the placenta absorbing nutrients via diffusion from the mother's blood supply, as well as from endometrial gland secretions, especially during early development (Gardner 1998, Hempstock 2004, Larsen 2001). After birth, the placenta (the "afterbirth") detaches from the endometrium. This is not necessarily accompanied by any bleeding because, as previously mentioned, no part of the placenta or embryonic blood supply is actually connected to the maternal blood supply. The placenta is, for lack of a better term, temporarily "glued to" the endometrium, but is not continuous with it on a cellular level.

While it may be true, as Effron claims, that "[s]ome beings that are alive owe their continued existence to complete dependence upon a physical attachment to a unique other", an embryo, certainly before implantation if not at all times, is not such a being (Effron 2005). Preimplantation embryos are not attached to a unique other. For example, it is because preimplantation embryos are not dependent upon a physical attachment to a unique other that in-vitro fertilization (IVF) and surrogate motherhood are possible (Behr

1999). It is quite feasible to remove a human ovum and combine it with sperm to create a viable embryo outside of the mother's body (Behr 1999). It is also theoretically possible to remove a viable embryo that was conceived in vivo from a woman's body and keep it alive (up to the point that implantation becomes necessary) outside of any woman's body, or implant it in a different woman. Again, this approach is possible, but it is more difficult than using IVF, so at this time IVF is the preferred means of obtaining extra-utero embryos for implantation. The conclusion to be drawn from this is that before implantation into a woman's endometrium, an embryo is not physically dependent on any adult human. At the time when implantation becomes necessary for survival, the embryo becomes only materially dependent. This is because the embryo could implant into any healthy endometrium, not just its biological mother's, making surrogate motherhood possible.

It is true, however, that an embryo is dependent on its environment even before implantation. An embryo must undergo cell division and differentiation to some extent before it becomes implanted into an endometrium, and this requires energy. Embryologists David Gardner and colleagues tell us that "the mammalian preimplantation embryo undergoes significant changes in its physiology during development. Concomitant with these changes are altering patterns of nutrient uptake" (Gardner 1998). The preimplantation embryo absorbs nutrients from the fluid matrix surrounding it, and it requires more and different nutrients at different stages of life. This makes it necessary to provide a suitable medium to IVF embryos during the period before transference to a woman's uterus (Behr 1999). Several types of nutrients are utilized by the preimplantation embryo, such as proteins, carbohydrates, sugars, and so on. While it is necessary that a preimplantation embryo receive adequate nutrition, it is not necessary that the embryo receive those nutrients from its biological mother. It can survive in vitro or in the uterus of another woman. The preimplantation embryo's dependence on these nutrients is not physical or material dependence, but general dependence. It should be pointed out that certain of these nutrients are essential for survival, but that this is also true for adult humans. An adult requires certain essential proteins for survival, but is not materially dependent because he or she can acquire these proteins from a multitude of sources. This is also true of the preimplantation embryo.

Even if the embryo is not physically dependent on its mother before implantation, it could be argued that implantation marks the beginning of an irrevocable physical dependence. However, there is a significant period of time after implantation that the embryo is not dependent on the mother's blood supply. Embryologists Joanne Hempstock and colleagues explain that

"[t]he maternal circulation to the human placenta is not fully established until 10–12 weeks of pregnancy. During the first trimester the intervillous space is filled by a clear fluid, in part derived from secretions from the endometrial glands via openings in the basal plate" (Hempstock 2004). During this period of development the embryo is not dependent on the mother's blood supply, despite establishing a connection between the placenta and endometrium, but only on endometrial secretions.

As previously mentioned, the intervillous space separates the mother's blood supply from the embryo's placenta throughout development. Because of the intervillous space, it is theoretically possible that an embryo's placenta could be disconnected entirely from his or her mother's endometrium and transferred to another endometrium at any stage of development. This would have to be done extremely quickly to prevent the embryo from dying of oxygen/nutrient starvation, and of course the differentiation between the placenta and uterus is not clearly apparent to the naked eye. Because of this it is not currently feasible to transplant, say, a twenty week fetus from one uterus to another. It would also be difficult to induce a non-pregnant uterus to secrete the necessary nutrients, expand to a size capable of holding the fetus, and so on. Nevertheless, it is entirely biologically possible to perform a fetus transfer. For example, it may become feasible in the future for a dying pregnant woman to obtain a surrogate into which her fetus could be transplanted. At this time it is not possible to perform such a medical intervention successfully. However, because it is biologically possible to perform such a procedure, there is nothing inherent in the biology of a fetus that renders it physically dependent. It is physically dependent only because of extrinsic circumstances. In light of this, consider again Effron's claim that "the materially dependent being can be transferred, as a separate and bounded person, from one attachment to another. The physically dependent being, however, cannot be transferred as a separate and bounded person" (Effron 2005). This differentiation means that an embryo before implantation is not physically dependent. It also means that an implanted embryo is not necessarily physically dependent, but only materially dependent, because inherent in its biology is the capacity to be transferred as a separate and bounded entity. Thus far it is simply not feasible to do so.

Even if one grants the claim that an implanted embryo is physically dependent on its mother, it cannot be ignored that an embryo before implantation is physically independent. This means that an embryo begins life as a generally dependent organism, the same state of dependence that is experienced by healthy adult humans. When an embryo reaches the stage that implantation is necessary it becomes materially dependent, because it could implant in any suitable endometrium. Only after it is implanted can an embryo be called physically dependent, if it is ever possible to call an embryo physically dependent. After birth the stages of dependence will reverse, from being a materially dependent neonate to eventually becoming only a generally dependent adolescent/adult. If an embryo becomes physically dependent, it does so only temporarily.

It may be useful to consider one other comparison. Conjoined twins are identical twins who have not fully separated anatomically (Kaufman 2004, O'Neill 1988). Recall from chapter two that twinning occurs when an embryo divides before genetic restriction. Conjoined twins arise from a single embryo that begins to divide right around the stage of genetic restriction (Kaufman 2004, O'Neill 1988). Because genetic restriction has begun, the embryonic cells are not totipotent and cannot each develop into all the cell lines necessary for survival. The embryo cannot divide completely without both resultant embryos dying because each resultant embryo would lack one or more important cell line. Because of this conjoined twins do not divide completely. Conjoined twins always share some tissue; sometimes they share a vital organ and cannot be surgically separated without one or both twins dying (Kaufman 2004, O'Neill 1988). It is sometimes the case that a vital organ develops in only Twin A, for example, and not in Twin B. Twin B, then, is biologically continuous with Twin A and is also physically dependent on Twin A, because Twin B cannot be separated from Twin A and survive. In this situation Twin B is more directly connected to Twin A than an embryo is to his or her mother; there is a clear boundary between the mother's body and the embryo's body, but this is not the case with conjoined twins. If the twins survive to adulthood, then Twin B will be a physically dependent entity who nevertheless has developed consciousness, exhibits rational behaviour, and so on. If the claims of Effron, Bedate and Cefalo that we should deny personhood to embryos because they are physically dependent are correct, then we should also deny personhood to the conscious adult Twin B, because he or she is a physically dependent entity (Bedate 1989, Effron 2005). I do not believe that adult conjoined twins should be denied personhood, and though Effron, Bedate and Cefalo do not address this subject, I presume that they would agree with me on this point. Because of this, I reject their claims that being a part of and physically dependent upon another human is grounds for denying personhood.

In this chapter we have explored the nature of dependence and its relationship to personhood. Specifically, some philosophers have argued that embryos cannot be persons because they are only a part of some other entity and are thus physically dependent on that entity for their existence. I have presented evidence that an embryo is never actually biologically continuous with its mother's body. I have also argued that even after implantation, the embryo is not necessarily a physically dependent entity, since it is biologically possible that it could be transferred from one to another uterus. Even if one takes a view of physical dependence that defines an implanted embryo as a physically dependent entity, the embryo did not begin its life in that state. If we accept that physical dependence is sufficient grounds for denying personhood, and that an implanted embryo is physically dependent, then we must accept the conclusion that an early third trimester fetus is certainly not a person but that a preimplantation embryo could be. Such a conclusion, I believe, is unacceptable. Additionally, there are adult humans who are directly biologically connected to and physically dependent upon another human. If we accept the criterion of independence as a prerequisite for personhood, then we have more cause to deny personhood to these adults than to preimplantation embryos. For these reasons, I believe we should reject the criterion of independence with regards to personhood, or at the very least recognize that embryos are just as independent as some adults in every morally significant sense of that term.

Chapter 4

Attaining Consciousness

In this chapter I will explore the nature of human consciousness and its relationship to personhood. I will discuss first the view held by some philosophers that nothing can be a human person unless it is conscious, and that embryos are not persons because they are not conscious. I will then examine criteria related to consciousness, specifically possession of the capacity for consciousness and possession of dispositional beliefs. Through an examination of neurological data I will show that sleeping adult humans, at least in specific stages of sleep, lack such proposed criteria to the same extent as human embryos. I will assume in this chapter that sleeping adult humans are persons despite failing to meet these consciousness criteria. I conclude from this that consciousness is not a necessary condition for personhood and that human embryos cannot be denied personhood solely on the grounds of lacking consciousness.

First let us examine the unqualified criterion of consciousness proposed by some thinkers. Neurologist Ronald Cranford writes that "consciousness is the most critical moral, legal, and constitutional standard, not for human life itself, but for human personhood" (Cranford 1987), and philosophers Nicole Hassoun and Uriah Kriegel write that "it is impermissible to intentionally kill a creature only if the creature is conscious [...] if a creature is not conscious, then it is not a person, not the sort of thing whose death is intrinsically or non-derivatively deplorable" (Hassoun 2008). While these authors do not specifically mention sleeping adults, I presume that they would not deny the personhood of sleeping adults. Perhaps they consider sleeping adults as being merely in a state of decreased conscious awareness. After all, the level of consciousness of waking and sleeping adults can fluctuate. An adult concentrating on several tasks could be said to be more consciously aware than a daydreaming adult, for example. Similarly, one might suppose that sleep is only a state of attenuated consciousness. I turn now to a chemical and anatomical comparison of the states of the sleeping and waking human brain to show that the (deeply) sleeping brain is not only unconscious, but is incapable of consciousness in its present state.

One reason to think that the sleeping human brain can be conscious is the occurrence of dreams. Dreams are typically comprised of visual, and sometimes auditory, experience that is sometimes remembered after waking (Hess 1987). Dreams only occur in humans during the lightest stage of sleep, however, known as rapid eye movement (REM) sleep (Hess 1987). REM sleep differs from non-rapid eye movement (NREM) sleep, also referred to as slow-wave sleep (SWS), in a number of ways (Hess 1987). Neurologists C. W. Hess and colleagues write that in their study

> Motor responses were evoked during sleep using stimuli identical to those used in wakefulness. Response amplitudes were depressed during slow wave sleep and enhanced or the same during REM sleep (Hess 1987).

These data suggest that REM sleep differs from NREM sleep in terms of electrical activity and neuronal excitability. REM sleep also differs from NREM sleep in terms of connectivity of neuron groups, which neurons are active and which are inactive, and the biochemical composition of the brain (Braun 1997, Gallopin 2000, Hess 1987, Hiroki 2004). While the brain during REM sleep is demonstrably different from the brain during NREM sleep, it is the differences between the waking brain and the brain in NREM sleep that are most relevant to our discussion.

The human brain during NREM sleep differs significantly from the waking state, both in terms of anatomy and biochemistry. The gross anatomy and global biochemistry of the brain as a whole alter only subtly, but even on this large scale the change is significant. Neurologists Masahiko Hiroki and colleagues note that in their experiments

> As NREM sleep progressed, mean arterial blood pressure and whole brain mean CBF [cerebral blood flow] decreased significantly; arterial partial pressure of CO_2 and, selectively, relative CBF of the cerebral white matter increased significantly (Hiroki 2004).

Whether the cerebral blood flow and carbon dioxide concentrations in the brain change as a result of decreasing metabolic requirements of the brain during NREM sleep, or whether these slight anatomic and chemical changes help bring about NREM sleep, is unclear. What is clear is that the waking brain could not perform its functions properly under these conditions. This is because more areas of the brain are active in the waking state, and the areas that are active in both sleeping and waking require more energy in the waking state. The oxygen levels and cerebral blood flow are too low in the sleeping state to support the metabolic requirements of wakefulness.

These global changes are not the only changes between the brain in NREM sleep and the brain in wakefulness. Neurologists Pierre Maquet and colleagues, studying regional differences in cerebral blood flow changes, note

> a significant negative correlation between the occurrence of SWS [slow-wave sleep] and rCBF [regional cerebral blood flow] in dorsal pons and mesencephalon, thalami, basal ganglia, […]. Given the known decrease in global cerebral blood flow levels during SWS, these negative correlations suggest that rCBF is decreased significantly more in these cerebral areas than in the rest of the brain (Maquet 1996).

Structural changes associated with differential blood flow are biologically important, but are not the most morally significant changes that occur during deep sleep. Neurologists A.R. Braun and colleagues note more profound alterations of neuroanatomy during NREM sleep. Braun et al. tell us that in their experiments they have observed that "SWS was associated with selective deactivation of the heteromodal association areas [...] SWS may not, as previously thought, represent a generalized decrease in neuronal activity" (Braun 1997). The important thing to note from this experimental data is that various areas of the brain are deactivated during deep sleep while others remain active. This means that the brain as a whole does not simply decrease activity uniformly, but selectively fluctuates activity in various areas, thus altering the functional capacity of the brain as a whole.

Not only are some areas of the brain deactivated during NREM sleep, but some areas that are never active during wakefulness are activated in deep sleep. Neurologists Thierry Gallopin and colleagues write:

> we identify sleep-promoting neurons *in vitro* and show that they represent an homogeneous population of cells that must be inhibited by systems of arousal during the waking state. [...] these neurons are inhibited by noradrenaline and acetylcholine, both of which are transmitters of wakefulness (Gallopin 2000).

Neurologists Clifford Saper and colleagues provide further evidence:

> The ventrolateral preoptic nucleus contains GABAergic and galaninergic neurons that are active during sleep and are necessary for normal sleep. The posterior lateral hypothalamus contains orexin/hypocretin neurons that are crucial for maintaining normal wakefulness. [...] wake- and sleep-promoting neurons inhibit each other, which results in stable wakefulness and sleep (Saper 2001).

This means that not only the concentration, but also the types of neurologically active chemicals present in the brain differ between the deeply sleeping and the waking adult brain. Also, some areas of the brain are active only in sleep, while others are active only in waking states.

The disconnection of some areas of the brain from other areas during sleep requires some explanation. It has been historically believed that sleep is primarily restorative; however, there is significant activity in many areas of the brain during sleep (Gallopin 2000, Maquet 1996, Saper 2001). This includes both electrical activity and anatomic changes. During wakefulness sensory information is acquired, and new skills may be practiced. Learning new skills and acquiring new memories requires the establishment of new neuronal connections (Maquet 1996, Saper 2001). During sleep the human brain is changing neuronal pathways in ways that are not possible during wakefulness. This involves some neurons growing new axons and dendrites or expanding existing axons and dendrites to reinforce connectivity between, for example, areas of motor control after a day spent learning a new skill that utilizes manual dexterity. Some new skills or memories require the creation of connections between cells that were never connected before. Conversely, the neural pathways involved in a complicated skill that is not practiced will eventually be dissociated. In this way cellular material is not wasted on maintaining knowledge or skill sets that are not beneficial to the survival of the organism. From this we see that the brain during sleep undergoes not only physiological, but also anatomical changes.

It is because these anatomic changes in the brain are necessary that the sleep state also requires disconnections between certain areas of the brain. Some areas of the brain have increased activity during sleep because of the previously discussed anatomical connective changes that are taking place. This also explains the selectively higher cerebral blood flow to these regions during deep sleep. If the neurons connecting different areas of the brain during wakefulness continued to connect those areas during sleep there would be unhealthy consequences. Consider, for example, the relatively benign occurrence of nocturnal myoclonus, also known as restless leg syndrome (Bixler 1982). A myoclonus is an involuntary muscle contraction. Nocturnal myoclonus occurs because certain parts of the motor cortices of the brain that are normally disconnected from one another and from the spinal nerves do not disconnect properly when the brain alters to the sleeping state (Bixler 1982). When these neurons engage in the increased electrical activity that normally occurs during sleep, the electrical impulses are not halted by the normally present axonal and dendritic disconnects and instead propagate along the motor neurons controlling the musculoskeletal system, most commonly affecting the lower limbs.

This raises the question of how different areas of the brain are disconnected during NREM sleep. There are different methods utilized for different neurons and different areas of the brain. It will suffice here to discuss just one of the more common methods, which has been alluded to previously. The brain in deep sleep has a significantly different biochemical makeup from the waking brain, and some of the neurotransmitters present are sleep-promoting. Neurons must receive information from other neurons via the medium of neurotransmitters, which bind with receptors on the dendrites of neurons and cause nerve impulses. Some chemicals, such as sleep promoting neurotransmitters, can bind with these receptor proteins and prevent a group of neurons from receiving information from other neurons. In this way certain neurons can be rendered physically unable to receive information from neurons with which they normally communicate during wakefulness. This, along with the creation and destruction of certain cellular connections, shows that the anatomy of the brain during deep sleep is significantly different from the anatomy of the waking brain.

The sleeping brain's altered anatomy has consequences that are of moral significance. Consciousness requires complex neural connections. Because these neural connections do not exist in a human brain during NREM sleep, a deeply sleeping adult human not only lacks consciousness, but lacks also the basic neural connections that give rise to consciousness. The adult in NREM sleep lacks certain necessary physical elements (neuronal connectivity and sufficient blood flow) and chemical elements (sufficient oxygenation and wake-promoting compounds) necessary for consciousness. What this means is that an adult human in deep sleep must undergo anatomical and biochemical changes in order to become an entity that will have the neural configurations required for consciousness. At this point it is possible to make a comparison of the adult human in NREM sleep and the developing human embryo. Both the adult in NREM sleep and the embryo must undergo significant biological changes in order to become an entity that is capable of consciousness.

If the claims of philosophers such as Hassoun and Kriegel are correct, that "if a creature is not conscious, then it is not a person, not the sort of thing whose death is intrinsically or non-derivatively deplorable", then deeply sleeping adults are not persons (Hassoun 2008). Hassoun and Kriegel do not draw this particular conclusion. They do, however, point out that "[i]t is an entirely empirical issue at what stage a human develops a concept of self — an ability to distinguish itself from anything that is not itself" (Hassoun 2008). In this statement Hassoun and Kriegel are referring to the embryo, which lacks consciousness, and to the neonate, which also lacks self-consciousness, but in light of the previously discussed neurological evidence, their statement is equally true of an adult human in NREM sleep. That is, it is an entirely empirical issue at what stage an adult human waking from sleep acquires a concept of self, just as it is an empirical issue at what stage a neonate acquires a concept of self.

Our commitment to the personhood of deeply sleeping adults, despite their lack of consciousness, requires a conclusion that present possession of consciousness is not a necessary condition for personhood. This also applies to criteria for personhood that are more restrictive than simple consciousness. Philosopher Michael Tooley agrees with Hassoun and Kriegel that it is not only consciousness, but self-consciousness that is a crucial component of the human person. Tooley asserts that

> An organism possesses a serious right to life only if it possesses the concept of a self as a continuing subject of experiences and other mental states, and believes that it is itself such a continuing entity (Tooley 1972).

Philosophers Lisa Bortolotti and John Harris echo Tooley's sentiment. They write that

> Sentience is a prerequisite for having an interest in avoiding pain, and personhood is a prerequisite for having an interest in the continuation of one's own existence. Early human embryos are not sentient and therefore they are not recipients of direct moral consideration (Bortolotti 2005).

If these philosophers' assertions are correct then self-consciousness is a necessary condition of personhood. This would mean, however, that an adult human in NREM sleep is not a person, because self-consciousness requires consciousness. The adult human brain in NREM sleep does not have a conscious interest in the continuation of its own existence. If a sleeping adult human has any interest in his or her continued existence at all, it is not a more complex interest in continued existence than such an interest held by any animal, especially if the animal in question is in a waking state. Additionally, if such an interest could exist during deep sleep, it would have to be an unconscious one, and we could just as easily argue that an embryo has as much of an unconscious interest (if there is such a thing) in its continued existence as an adult human in NREM sleep.

The authors cited thus far may have meant that it is morally significant for a being to have attained consciousness at some time in the past, rather than be conscious currently, in order to be a person. This would mean that attaining consciousness for the first time is what is morally significant, though none of the authors mentioned say this directly. To address such a view we must examine whether having had consciousness in the past is morally significant. To do this I will consider two counterexamples: the brain dead patient, and the patient with total amnesia.

It is instructive to compare the deeply sleeping brain to that of a brain dead patient. Recall from chapter 1 that a patient is brain dead when his or her brain has permanently ceased to function as an integrated whole. This means that some areas of the brain could continue living and functioning temporarily in a brain dead patient. Some of the neurons involved in certain memories and desires could continue to function; however, since the brain is not integrated, the patient does not remember those memories or actively experience those desires. This is similar to the brain in deep sleep, which is not currently functioning as a whole in an integrated way but contains the rudimentary components of memories and desires. Both the brain dead and deeply sleeping patients have neural activity that is disintegrated, though the deeply sleeping patient has a larger amount of neural activity. The major difference is that the deeply sleeping patient will have integrated activity of the brain as an integrated organ in the future. The loss of personhood of the brain dead patient seems to indicate that personhood relies on whether future states of consciousness are possible, as personhood does not rely solely on the possession of past states of consciousness.

It is true that when a sleeping patient wakes he or she will resume consciousness, rather than attain consciousness for the first time. However, as cases of amnesia demonstrate, it is possible to imagine a patient attaining consciousness without any connection to a past state of consciousness. Normally a patient attaining consciousness will recall events that happened the day before, and will engage in activity that is in accordance with plans made previously. This is a case of effectively resuming a past state of consciousness based on information stored in memories. In cases of short-term memory loss due to organic amnesia, however, a patient may wake one day with no memories of the past day or many days (Kopelman 1994, Huppert 1978). Patients with organic amnesia are unable to form new memories, and so anything experienced on a given day after the onset of organic amnesia will be totally forgotten relatively quickly (Kopelman 1994, Huppert 1978). It is impossible for such a patient upon waking to resume the conscious state of the previous day, as he or she has no idea that the previous day occurred without consulting a calendar. During deep sleep such a patient lacks integrated brain function and will be unable to resume at least the most recent states of consciousness he or she experienced (and we can envision extreme cases in which no memory is retained). If this patient is still a person during deep sleep, it can only be because he or she is capable of acquiring consciousness in the future. Because a deeply sleeping patient with severe organic amnesia is not currently conscious and will not upon waking have any connection to past states of consciousness, the only morally significant aspect of human consciousness must be the ability to acquire consciousness at a future point in time, regardless of current or past possession of consciousness.

We have seen that any criteria for personhood that require current consciousness are not met by the adult human in NREM sleep. I will now turn to considerations of the capacity for consciousness and possession of dispositional beliefs.

Of the philosophers mentioned thus far, only Tooley addresses the problem of temporary unconsciousness in adult humans. He suggests that

> the term “desire” [...] involves reference to something more than behavioral dispositions [...] an individual's right to X can be violated not only when he desires X, but also when he would now desire X [if he were not now] temporarily unconscious [...] one's right to something can be violated only when one has the conceptual capability of desiring the thing in question (Tooley 1972).

Tooley points out that there is a difference between actively believing or desiring something at any given moment and passively possessing a belief. A belief that is held but is not currently being consciously thought about is sometimes referred to as a dispositional belief; that is, when confronted with certain stimuli a person will tend to affirm a certain belief with an appropriate response. For example, an adult human might passively possess the belief that the planet Earth is round. Only when consciously thinking about the shape of the planet Earth does the adult actively believe that it is round. When not thinking about the shape of the planet Earth, the adult has only the disposition to believe that it is round, and will actively affirm that belief when presented with proper stimuli.

The biological basis of dispositional beliefs needs explication at this point. Consider the belief that the Earth is round: this belief relies on knowledge of shapes (contained in the right cerebral hemisphere), certain visual memories, such as a memory of a textbook illustration or photograph of the Earth (contained in the occipital lobe), linguistic understanding of the terms "Earth" and "shape" (contained in the left cerebral hemisphere), and so on. All of these pieces of information play a role in an adult responding affirmatively to the question "Do you believe the Earth is round?" When the neurons in the particular neural pathways connecting these pieces of information are not firing in a certain way, the adult's brain is not actively thinking about the shape of the Earth. The adult nonetheless possesses the dispositional belief that the Earth is round. This is because the neural pathways connecting these various areas of the brain, and the information they contain, exist despite the fact that they are not currently active. The adult is in a state such that he or she has the neural disposition to think in a certain way given certain stimuli. Now consider what we know of the brain's disconnectivity during NREM sleep. Some of the various areas involved in the belief "the Earth is round" are not connected. That is, it is not merely the case that the neural pathways responsible for the active belief "the Earth is round" do not fire during deep sleep; rather, these neural pathways do not exist during deep sleep. The adult in NREM sleep thus does not have the dispositional belief that the Earth is round, but will gain the capacity, the disposition for, that belief after undergoing essential anatomical and biochemical changes.

Returning to Tooley's argument, he claims that a sleeping adult, though not actively believing or desiring certain things, *would* actively believe and desire certain things because he or she has dispositional, or passive, beliefs (Tooley 1972). I believe I have demonstrated why a sleeping adult does not possess the disposition to believe, but only the disposition to become something that can believe, a disposition the sleeping adult shares with a human embryo.

It is true that an adult human, even during NREM sleep, retains certain information that will be accessible upon waking. One might say that a sleeping adult has the ability to access this latent information after undergoing biological changes, and thus has an extended kind of disposition to believe. While this is typically true of sleeping adults, however, it is not always the case. An unconscious human can be deprived of latent information, and thus of dispositional beliefs. Consider once again the hypothetical unconscious patient who suffers total amnesia. Such a patient would lose all connection to past states of consciousness. Such a patient would also lose all of his or her dispositional beliefs. That is, during the time when this person is unconscious and has had all neural pathways that contain memories, desires, beliefs, values, and all other person-specific information destroyed, he or she cannot be said to possess the disposition to remember, believe, or desire anything in particular. When this person awakens, he or she will acquire new memories upon which to base beliefs, but before waking has no such information. I suggest that the condition of the total amnesia patient is morally similar to that of the human embryo. Both the amnesia patient and the embryo lack both active and dispositional beliefs, desires, and so on, but both will acquire the ability for conscious experience and for the creation of beliefs, desires, and so on. If a patient who has recently become unconscious and who will suffer from total amnesia upon waking is a person, then having dispositional beliefs cannot be a necessary condition of personhood.

It might be possible that a deeply sleeping adult does, in fact, have the tendency to possess beliefs. Defining dispositional tendencies for the possession of beliefs in such a way that will include adults in NREM sleep will, however, also include human embryos. This, again, is because an adult in NREM sleep must undergo anatomical and chemical changes, which will result in the acquisition of information (in the form of memories) upon which beliefs are based. A waking human exists in a state such that he or she will tend to have a given belief or desire in response to given stimuli; a deeply sleeping human does not exist in such a state and must change significantly to be in such a state. In order to have a definition of dispositional beliefs that will allow the possession of such beliefs by deeply sleeping humans, the tendency to undergo changes anatomically and biochemically into an entity capable of possessing beliefs must be part of an entity's "disposition". Such a modified definition of dispositional beliefs would mean that embryos also possess dispositional beliefs. A human embryo possesses the tendency to change anatomically and biochemically into an entity capable of possessing beliefs, and in the course of that development will acquire information upon which those beliefs can be based.

In this chapter I have examined the position that consciousness is a necessary condition for personhood. Through the examination of neurological data I have shown that humans in NREM sleep are not conscious and are not capable of consciousness without undergoing significant biological changes. I have also examined similar criteria for personhood, specifically the capacity for consciousness and the possession of dispositional beliefs. Again, neurological data suggest that the deeply sleeping adult human does not possess either the capacity for consciousness or dispositional beliefs. I have assumed that deeply sleeping humans nevertheless possess the moral status of personhood. From this I conclude that consciousness, the capacity for consciousness, and the possession of dispositional beliefs are not necessary criteria for personhood. The importance of consciousness to personhood is that in order to be a person a being must have the ability to possess consciousness, dispositional beliefs, and so on *after undergoing natural anatomical/biochemical changes*. This morally significant aspect of consciousness is possessed by embryos, as well as deeply sleeping adults. For this reason, personhood cannot be denied to human embryos solely on the basis of lacking consciousness.

Conclusion

In this thesis I have attempted to demonstrate four things: 1) human embryos are human organisms; 2) individuality (understood as indivisibility of mind or body) is not a trait possessed by persons; 3) the dependence of human embryos on other organisms is not different in kind from the dependence of at least some adult humans on other organisms, and thus independence is not a necessary condition for personhood; and 4) consciousness is not a necessary condition for personhood.

From this I conclude that human embryos cannot be denied personhood based on the claims that they are not human organisms, that they are not individuals, that they are not independent, or that they are not conscious. I do not pretend that such a conclusion proves that human embryos are persons, but rather that reasons for denying their personhood must be demonstrated using other criteria. This will likely influence the debates regarding abortion and research that makes use of human embryos, and may also influence discussions regarding the personhood of non-human animals. It is my hope that this text will further our collective understanding of personhood and bring us closer to an accurate description of personhood as a specific moral status.

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Vita

The author of this text, gabriel Lee Edmondson, was born on the seventeenth of November, nineteen eighty-six, in Tifton, Georgia. At the age of sixteen he began his formal education at Middle Georgia College, from whence he transferred to Mercer University in two-thousand five. He received his Bachelor's of Science in Biology from Mercer University in two-thousand eight. Having finished his undergraduate education he resumed the decidedly more enlightening task of independent studies in literature, art, science, and metallurgy in an attempt to understand his own nature and the nature of the universe in which he resides. This quest eventually brought him to Wake Forest University where he completed the requirements for the Master's of Arts in Bioethics, the final requirement of which is this thesis. He looks forward to furthering his understanding in the near future through the study of human medicine at the Edward Via Virginia College of Osteopathic Medicine.