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I am submitting herewith a thesis written by Tatjana Weidmann-Hugle entitled "An Ethical Assessment of Preimplantation Diagnosis Compared with Conventional Prenatal Diagnosis." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Philosophy.


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**AN ETHICAL ASSESSMENT OF PREIMPLANTATION DIAGNOSIS
COMPARED WITH CONVENTIONAL PRENATAL DIAGNOSIS**

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To Stefan (a.k.a. Mi...)

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ABSTRACT

Preimplantation diagnosis (PID) is a recently developed technique in the area of prenatal genetic testing. It combines in vitro fertilization (IVF) with the cytogenetic analysis of the preimplantation embryo. Its primary purpose is to serve couples who are carriers of monogenetic disorders and who therefore have an increased risk for conceiving a diseased or disabled child. In this thesis I am going to assess this method in comparison with conventional prenatal diagnosis (PND) after amniocentesis or chorionic villus sampling. First, I will examine the question of whether the human embryo and fetus can be regarded as persons. Within this context I will also address the problem of the use of embryos in research. Second, I will compare and analyze the moral and ethical differences between selective abortion following PND and the discard of the embryo after PID. The discussion is going to focus on the following issues: (1) the analysis of the change from the *in vivo* (PND) to the *in vitro* (PID) environment and the associated implications, and (2) the discussion of arguments favoring PID over PND. I will conclude that PID and PND are both acceptable procedures, depending on the particular situation and previous experiences of the couple who is a carrier of a genetic disease, and who wants to make use of either of these techniques in order to prevent passing on the disease to the offspring.

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1 INTRODUCTION

Since the beginning of the 1970s prenatal diagnosis has become a well-established method for detecting a disease or disorder before the birth of a child. In our society prenatal diagnosis as well as selective abortion to avoid the birth of a seriously impaired child, has been widely accepted. Over time the range of methods for prenatal testing has continuously grown larger. Preimplantation diagnosis (PID) is a technique, which also is part of the general field of genetic diagnosis. In order to recognize or exclude genetic disorders PID combines *in vitro* fertilization (IVF) with the cytogenetic analysis of the preimplantation embryo. Its primary purpose is to serve couples who are carriers of monogenetic disorders and who therefore have an increased risk for conceiving a diseased or disabled child. In contrast to prenatal diagnosis (PND) after amniocentesis or chorionic villus sampling (CVS), PID enables the *in vitro* testing of the embryo for genetic defects before the embryo is implanted into the woman's womb.

In 1990 the first successful outcome of PID was achieved by the birth of twin girls whose mother was known to be at risk of transmitting X-linked mental retardation and adrenoleukodystrophy (Handyside et al., 1990).

Proponents of PID point out that this method offers couples at increased risk of having offspring affected with a genetic disorder the possibility of an early prenatal diagnosis. Couples who make use of IVF followed by PID have the

option of discarding afflicted embryos prior to transfer. According to the understanding of many who would be opposed to abortion, this approach would avoid the issue of pregnancy termination.¹ Verlinsky and Kuliev (1993: 1), for example, write that PID "will make it possible to overcome the most sensitive problem in the management of genetic disease – the problem of abortion, which, because it is not acceptable for some populations or ethnic groups, gives rise to negative reaction to preventive genetic programs."

Another motive for applying PID is that, under certain circumstances, couples at risk for late-onset dominant disorders such as Huntington disease and certain other dominantly inherited disorders could participate in prenatal genetic testing "without incurring the emotional, social and financial burdens that might result from the presymptomatic disclosure of their own carrier status" (Schulman et al., 1996: 58). This would result if the results of the genetic test(s) for each embryo (either positive or negative) would not be disclosed to the prospective parents and only embryos without the mutant gene would be transferred to the uterus, thus leaving the prospective parents in the dark about their own carrier status.

Some researchers see embryo testing as a means to move toward the elimination of certain types of serious genetic diseases. The following statement by Schulman et al. (1996) illustrates this:

¹ There are people who regard any termination after fertilization as an abortion. For them PID would not obviate this issue.

This proposal also has important public health implications. In Huntington disease, nearly all cases arise in pre-existing Huntington families rather than as new mutations. These procedures [IVF and PID] therefore constitute a potentially effective strategy for greatly reducing or even eliminating Huntington disease from the population. IVF is now a widely accepted reproductive option. On the average, 2 to 3 IVF cycles are required to achieve a live birth in the best programs. In the U.S., IVF with PGT [prenatal genetic testing] is available for about \$10,000 per treatment cycle, and less in some other countries. Hence, for an average cost of about \$50,000 a couple containing one member at risk for having the Huntington gene could be on average assured of having two unaffected children *and the risk of disease in all future generations would be eliminated.* (p.58)

It is obvious that PID can also be performed in cases where IVF is medically indicated because of fertility problems of a particular couple. In these cases PID can be regarded as a way of maintaining 'quality control' of the embryos. This aspect of PID will not be discussed in this thesis because my primary focus will be on an ethical comparison between PID and PND.

In the following three sections I am going to introduce, first, the technique of IVF. A relatively detailed presentation will be given because IVF is, as already mentioned, a pre-condition for PID. Furthermore, in order to be able to make a sound assessment of PID compared with PND it is necessary to have a detailed background. Second, I am briefly going to describe the technique of PID. Finally, the ethical problems being raised by PID following IVF will be listed. Some of

these problems and the comparison between PID and PND are going to be the central concern of this thesis. Here, I would like to point out that this thesis will specifically be about an ethical assessment of PID compared with PND, and not of an assessment of PID alone.

1.1 IVF

In vitro fertilization (IVF) is a technique which was originally developed for the treatment of infertility. The basic or routine IVF protocol includes four stages of treatment: (1) stimulation of the ovulation (often also called superovulation), (2) egg recovery, i.e. removing one or more eggs from the woman's ovary, (3) fertilization – consists of placing the eggs in a petri dish and then adding sperm to the culture, and (4) transfer (or replacement) of the embryo into the woman's uterus. In the following pages I am going to describe the entire IVF procedure in more detail. I will also point out the medical risks which a woman who undergoes this procedure has to tolerate.

It is important to note in this context that both prospective parents who want to make use of PID (and IVF/ET) are, as far as fertility is concerned, healthy. In other words, they also could conceive a child in a natural way. Infertility is therefore not the medical indication for the application of IVF; rather IVF is the pre-condition for PID.

In order to have enough embryos for implantation, women who undergo IVF are, in a first phase, 'superovulated' by administration of large doses of various synthetic hormones, which stimulate their ovaries to produce more than one ripe egg. Although the overall effects of these hormones on women's health have not been extensively documented, there certainly are side effects of such superovulation (LeMoncheck, 1996). They may include ovarian enlargement, burst ovaries, ovarian cysts, cancer, or permanent infertility. Bloating of the ovaries, migraines, visual blurring, or dizziness are also not uncommon. As far as preimplantation diagnosis is concerned, ovarian stimulation is of even greater importance than in 'ordinary' IVF because sufficient embryos need to be gained for genetic diagnosis.

Egg recovery or harvesting is typically achieved by laparoscopy – a surgical procedure under general anesthesia whereby incisions are made through the woman's abdomen so that a laparoscope (a fiber-optic viewing tube), forceps, and a Teflon-coated needle can be inserted. Carbon dioxide is used to bloat the abdomen. The ovaries are held with the forceps while the needle is inserted into the stimulated (mature) follicles in order to recover the eggs by using a vacuum pressure device. Besides the risks attendant upon general anesthetics, this procedure can damage the woman's ovaries.

Ultrasound directed oocyte recovery is a more recently developed method of harvesting eggs from the stimulated follicles. Using a local anesthetic, a needle is inserted either through the woman's bladder, the urethra, or the vagina in order to suck out the eggs. Apart from being painful for the woman, this procedure poses the risk of infection from the incision through her bladder. Although ultrasound directed oocyte recovery is cheaper and less invasive compared with laparoscopy, many practitioners prefer laparoscopy because more eggs can be retrieved using this method.

The next step is the actual *in vitro* fertilization. The extracted eggs are placed in a culture dish. With the objective that some or all the eggs will fertilize, sperm is added to the culture. Any resultant embryos are kept in culture for 2 to 3 days, while they grow and divide into two, four, and then eight cells. At about this stage, the embryo must be transferred into the woman's uterus if it is to have any prospect of implanting and developing into a child.² Therefore, embryo biopsy, which is necessary for PID, has to be performed at the early cleavage stage.³ During this period of time the woman is continuously administered hormones in order to prepare her for the final step of the IVF process, the embryo transfer.

² Theoretically embryos can be grown *in vitro* to the later blastocyst stage where the early embryo consists of hundreds of cells. No pregnancies, however, have resulted from embryos transferred at such a late stage of development.

³ To minimize the reduction of the embryonic mass involved in removing a single cell, embryos have been biopsied as late as possible – which usually is at the eight-cell stage. This leaves 8 to 12 hours for genetic analysis before transferring the selected embryo(s) into the uterus.

In a final step, three or four embryos are typically transferred (using a catheter through the cervix) into the woman's uterus so that they can implant. Until a pregnancy is established the hormone progesterone is usually administered to offset the high levels of estrogen that result from superovulation. High estrogen levels seem to be involved in the relatively high failure rate of implantation, where the IVF cycle fails most often.

Apart from being a costly⁴, extensive, and invasive procedure, IVF is also a very inefficient form of treatment. One of the major problems is the very high rate of early embryonic death, even during cleavage stages, so that embryos grown *in vitro* have a maximum chance of only 25% of implanting into the uterus (Edwards, 1993: 23). The success rate of live birth per woman per cycle of IVF treatment is rather low. Although it varies between different centers⁵ it is approximately 10 to 15% (Winston & Handyside, 1993). Since IVF in the context of PID would mainly be used for fertile couples, there are claims that the success rate of IVF could be higher than the success rates for infertile couples, which have been reported so far. Nevertheless, at this point in time this has to be regarded as merely speculative because there are no data in support of such an assumption.

⁴ McClure (1996) gives an interesting overview on the costs of IVF (p.43).

⁵ The possibility of a live birth for any couple undergoing treatment will not only depend on the success rates at the individual center but also on the characteristics of the couple seeking the treatment.

1.2 Preimplantation Diagnosis

Up to now a number of different techniques for prenatal genetic diagnosis have been developed. One of the most recently discovered of these is a technique known as preimplantation diagnosis (PID). In contrast to other methods of prenatal diagnosis (amniocentesis and chorionic villus sampling), this approach allows testing at the embryonic stage of development and before the embryo is transferred into the uterus or into the fallopian tube. There are two ways in which embryos can be obtained for PID: 1) by uterine lavage after *in vivo* fertilization with timed intercourse or insemination, or 2) after *in vitro* fertilization (Goldberg et al., 1993). Due to low efficiency of embryo recovery using uterine lavage, the second strategy is applied in most cases. Following *in vitro* fertilization (IVF), the material for molecular genetic diagnosis is gathered by biopsy and removal of one or two cells from the early embryo. In cases where biopsy is successful, biopsy procedures do not seem to influence the normal embryonic development adversely (Goldberg et al., 1993; Handyside et al., 1992).⁶ The embryos that survive biopsy and are determined not to be affected by the genetic disorder tested are subsequently transferred back to the woman undergoing treatment. If biopsy reveals genetic abnormalities, the embryo is discarded.

⁶ At the moment it cannot be precisely determined whether there are no adverse effects at all. This is due to the fact that most studies on the effects of biopsy have been carried out with animals. Furthermore, too few children who have undergone IVF and PID have been born so far and not enough data and long-term studies are available yet to allow one to make an

There are several technical problems involved in the application of this technique, but they will not be discussed in detail here. The major problem of this technique involves its accuracy when PCR (polymerase chain reaction)⁷ is used for gene amplification. As far as the accuracy of PID is concerned, there have been probability errors for PID calculated when PCR is used for the amplification of the target gene sequence in one or more embryonic cells. According to Pergament and Bonnicksen (1994), error rates have been estimated to be as high as 1.8% for autosomal recessive genes, 15% for autosomal dominant genes, and 7.4% for X-linked recessive genes. As these figures show, the error rates for PID are considerably higher compared to conventional prenatal diagnosis by amniocentesis or chorionic villus sampling. Pergament and Bonnicksen (1994: 152) also write that "at least two diagnostic errors have already been reported: one of seven embryos was misdiagnosed as a female to parents at risk for an X-linked disorder, leading to a first trimester termination; and a misdiagnosis for cystic fibrosis resulted in the birth of an infant with the disease."

In the application of PID the safety of the developing embryo is a major concern. As noted above, an embryo seems to develop normally after successful biopsy. Moreover, there are reports of 'normal' infants born following this

unambiguous claim about the adverse effects of embryo biopsy.

⁷ PCR is a technique that is used for the amplification of short DNA or RNA sequences. It permits the analysis from very small quantities of DNA or RNA.

procedure. Nevertheless, too few infants have been born to know if there will be any long-term effects. Studies in animals, however, argue for a lack of substantial effect on mammalian embryos in general.

1.2.1 Tested Disorders

With the improvement of the technique and the rapidly unfolding genetic knowledge the number of conditions which can be detected by PID will increase continuously. It would definitely go beyond the scope of this thesis to try to present a comprehensive list of disorders currently being tested by PID. Nevertheless, in this section I would like to mention a few disorders⁸ for which PID is currently used. From this one can get an idea about the genetic properties and the severity of these disorders for which this method seems to be applicable.

The most common analysis done on human embryos has been the determination of gender⁹ in order to diagnose X-linked genetic disorders such as Duchenne and Becker muscular dystrophy, adrenoleukodystrophy (Handyside et al., 1990), or Lesch-Nyhan syndrome. This is done to prevent mothers who are carriers of X-linked diseases from passing on the disease to their male offspring. Only female embryos are implanted into the uterus.

⁸ Schulman and Black (1993) present a helpful overview on the genetics and the clinical manifestations of some common inherited diseases.

⁹ It is important to take note of the fact that this practice leads to a 50% chance of terminating a healthy embryo. I can imagine situations where this might matter. One could suppose, for example, a case where a woman already terminated two or more pregnancies because the fetus was male and then for some reason was unable to become pregnant again. She might regret missing out on the possibility of having a child.

Preimplantation diagnosis is also particularly amenable for single gene disorders such as cystic fibrosis, sickle cell anemia, thalassemia, and Tay Sachs disease.

1.3 Ethical Problems in the Context of PID and PND – an Overview

The possibility of genetic diagnosis at such an early stage of embryonic or fetal development raises a plethora of moral and ethical questions. The question about the moral status of the human embryo and fetus is certainly of major importance in this context. This is because, on the one hand, PND involves (in cases where a pathological result for the examined disorder is obtained) a decision about the abortion of a developing fetus. The use of PID, on the other hand, means that (in cases where the preimplantation embryo is positive for a tested disorder) the embryo will not be implanted into the woman's uterus and it will be discarded or possibly used for scientific research.

Not only PID but also PND raises the question of how we, as a society, define what constitutes a disease or 'serious defect' and how we distinguish these from 'minor conditions'. In the context of preimplantation diagnosis, it will be necessary to decide which phenotypical traits of the future individual are determined to be a serious defect justifying the embryo not being implanted, and

which are only undesired qualities that do not fulfill expectancies of prospective parents or society in general.

If we continue on this line of thought, then it becomes evident that, as well as being subject to diagnosis, embryos can also be subject to treatment. The next logical step in the technological advancement would thus be preimplantation therapy or 'trying to fix' the diagnosed defect in the embryo. Such early manipulations of the embryo may open the door to germ-line genetic therapy or other alterations such as genetic enhancement of qualities (e.g. height or intelligence) which in our society are regarded as preferable. I will not discuss this issue in more detail; however to show that apprehensions of this type are not unjustified I would like to present the following, very interesting statement, originally made in the 1960s by the Nobel Prize winner Yoshua Lederberg (1998):

Man's control of his own development, "euphenics,"^[10] changes the means and also the ends of eugenics, as have all the preceding cultural revolutions that have shaped the species: language, agriculture, political organization, the physical technologies.... Should biologists give first priority to long-range eugenic concerns of human genotype, or the gravely imminent issues of human numbers and phenotype: the allocation of intelligence, motivation and longevity? When euphenics has worked itself out ... we shall more confidently design genotypically programmed reactions, in place of evolutionary pressures, and search for further innovations. Eugenics and euphenics are the biological

¹⁰ Lederberg introduced the term 'euphenics' meaning the "engineering of human development."

counterparts of education, a panacea that has a longer but equally contentious tradition. The troubled history of utopian education warns us to take care in rebuilding human personality on infirm philosophy. (p.295)

Furthermore, PID represents a new emerging technique still requiring further research. In order to improve and establish all the techniques necessary for PID, a lot of research – not to mention unavoidable experimentation with embryos – is still required. This raises important ethical questions concerning the use of embryos for research. These will be discussed in section 2.5.

Another important issue is the question about the allocation of hard-pressed medical resources. IVF, which is the indispensable pre-condition for PID, is a rather expensive and inefficient form of treatment. The use of IVF for prenatal diagnosis could therefore place an additional burden on resources. IVF/PID will probably remain in the realm of privileged high-tech treatment only available to those few couples who are in a sufficiently sound economic position to afford it.

As we have seen, PID and PND raise a number of interesting ethical questions. In this thesis I will focus on two major issues which I believe are important for an assessment of the use of preimplantation diagnosis compared with the use of conventional prenatal diagnosis. First, I will extensively discuss the moral status of – especially – the (preimplantation) embryo and the fetus. In

the course of this discussion I will present different lines of arguments for the determination of the moral status of the embryo and fetus. Thereafter, I will address the problem of the use of embryos in research which can be associated with the techniques of IVF and PID. Second, I will compare and analyze, in as much detail as possible, the moral and ethical differences between selective abortion following PND and the discard of the embryo after PID following IVF. The discussion is going to focus on the following issues: (1) the analysis of the change from the *in vivo* (PND) to the *in vitro* (PID) environment and the associated implications and (2) the discussion of arguments favoring PID over PND. After having finished my analysis of the comparison between PID and PND, I will finish this thesis with a brief summary. Further, I will conclude that PID and PND are both acceptable procedures, depending on the particular situation and previous experiences of the couple who is a carrier of a genetic disease and who wants to make use of either of these techniques in order to prevent passing on the disease to the offspring.

2 THE MORAL STATUS OF EMBRYO AND FETUS

Our knowledge and information about embryogenesis have never before been as detailed and extensive as they are nowadays. Morphology, physiology, and biochemistry of the embryonic and fetal development are very well explored, and we have quite accurate information about the entire developmental process, including gametogenesis, ovulation and fertilization of the egg, implantation into the uterus, and growth of the embryo and fetus until birth of the child. Despite this abundance of biological and medical knowledge about embryogenesis, there is no determinate and affirmative consensus about the moral status of the prenaté during its development. While the organic and genetic status of the embryo can be described and analyzed more and more accurately and in much more detail, there is considerable disagreement about its moral status.

At this point, I would like to emphasize that I do not think that biological and medical knowledge alone can be the basis for clarifying the moral status of the embryo. But I do think that scientific knowledge about embryonic development provides some important information in trying to answer the question about the moral status. This is because the moral status of the embryo is, according to most theories, dependent on the presence of certain organic characteristics and abilities of the embryo (e.g. ability to feel pain or appearance of brain waves). It is important to know how and when these characteristics and abilities develop. This knowledge should definitely be taken into consideration when it is

determined whether, to what degree, or if at all the human embryo acquires the moral status of a human person with all the associated rights. Nevertheless, this does not mean that the moral status of the embryo should be based on mere biological facts. Moreover, biological facts and definitions are not as clear-cut as they appear to be and are frequently a matter of ongoing discussion within the scientific community. Scientific facts alone can, therefore, not provide the answer to the question of the moral status of the prelate. The final outcome is an ethical judgment.

Before entering the realm of ethics and discussing the moral status of the embryo and fetus, I am first going to give a brief overview on the biological aspects of embryonic and fetal development. Within this section I will emphasize the fact that the developmental process of embryo and fetus has to be regarded as continuous and gradual. This will have certain important implications, which will in later sections be discussed in more detail. Second, I will discuss and reject the term 'preembryo,' which is often used in trying to answer questions about the moral status of the early embryo. Although the use of this term seems to be legitimate for a scientific description of the embryonic development, it lacks any ethical significance for the answer of the question about the moral status of the human early embryo.

2.1 Fertilization and Embryonic Development

Fertilization is a process – not a set moment – which takes place over many hours. During this process, the egg or oocyte fuses with a sperm to form a single cell – the zygote. This is the stage at which a new and unique genome comes into existence. After fertilization the division of the zygote into more than one cell (2 to 16) begins. Thereupon the embryo develops further and implants into the uterine wall. It is usually assumed that implantation is completed by the tenth day after fertilization. Around the fourteenth day, the so-called primitive streak¹¹ develops. This marks the time when only a single biologic individual is in the process of formation. After this event twinning,¹² i.e. further division into two embryos, and chimera formation¹³ (recombination) are no longer possible. Later, neural and heart development and the development of other organs follow, and the embryo takes on the appearance and traits of a fetus. By the seventh week surface organs such as hands, feet, and face appear and permit species-specific recognition. By the end of the eighth week these organs become even more prominent. This is also about the stage when the earliest spontaneous bodily

¹¹ "The primitive streak is the groove along the midline of the embryonic disk that establishes in the embryo its cranio-caudal (head-to-tail) and left-right axis. At about 14 days after fertilization a single organizing center, or node, appears near the edge of the embryonic disk, providing the first direction for the coherent establishment of the form of the embryo (morphogenesis). Thus the primitive streak is sometimes described as the 'initial band of cells from which the embryo (proper) begins to develop'." (Tauer, 1997a: 438)

¹² Twinning (or division into more embryos) results from the splitting of the early embryo. There subsequently occurs the development of more than one prelate.

¹³ The formation of a chimera can be regarded as the inverse of the twinning process. Two or more early embryos resulting from either a single or multiple independent fertilizations recombine and develop into a single prelate.

movements have been reported. The end of the eighth week is commonly regarded as the transition from embryo to fetus.

The landmarks in the development of the prelate, which are claimed to be determinants of the moral status of the embryo and fetus range from fertilization (conception) to birth. The landmark most highlighted, however, is the formation of the primitive streak. Another landmark, which was proposed by Baruch Brody, is the beginning of the brain function. According to Brody's view a functioning brain is essential for being human and when the brain stops functioning the person dies and goes out of existence. Therefore, the fetus "comes into humanity" when its brain begins to operate (Brody, 1975: 111). He justifies the significance of brain function the following way: "One of the characteristics essential to a human being is the capacity for conscious experience, at least at a primitive level. Before the sixth week, as far as we know, the fetus does not have this capacity. Thereafter, as the electroencephalographic evidence indicates, it does. Consequently, that is the time at which the fetus becomes a human being" (p.83).

As the discussion of the term preembryo will show, the developmental process after fertilization constitutes a continuum which makes it from an ethical as well as a biological perspective impossible to isolate a single event or landmark where moral status is acquired. Despite the identification of certain

(descriptive) distinct stages in the development of human life, biologists agree on the fact that the developmental process is continuous and gradual. Therefore, any fixed landmark in this continuous process has to be regarded as arbitrary. Grobstein (1985), for example, writes:

Development involves change that is continuous over time. As a descriptive convenience, conspicuous changes or events can be used as markers for stages. This should not obscure the fact that gradual and not instantaneous change is characteristic of development; the designation of all events at all stages is arbitrary. (p.214)

As a final remark, I would like to emphasize that there is clearly a difference in appearance between an early embryo, an embryo, an early fetus, and a more developed fetus. The fetus definitely begins to look recognizably human between 10 and 14 weeks after fertilization. By contrast, the embryo, particularly the early one, has no resemblance whatsoever to a human being. Yet, does this difference in appearance have any moral significance? The following discussion will elucidate this issue.

2.2 Clarification of the Terminology

2.2.1 The Term 'Preembryo'

In ethical discussions many people have become accustomed to the use of the term 'preembryo.' This term refers to the product of gametic fusion as it exists from fertilization until the appearance of the primitive streak approximately 14

days later. The following passage, by Steigleder (1998), illustrates why the use of this term is established.

By this term [preembryo] is usually meant the fertilised human egg (zygote) and the further stages of its development during roughly the first two weeks.... The pre-embryo has the "potentiality to produce", for instance, the embryo. The embryo itself has the "potentiality to become" an agent.... Thus, *the moral status of the human pre-embryo is different and much weaker than that of the human embryo* [my emphasis]. (p.245)

In the literature one can find a number of reasons and arguments supporting the 'preembryo' concept. One of the most often cited reasons stems from the observation that the fetus is not formed out of the entire embryo but only parts of it, and therefore the early embryo cannot be regarded as a coherent entity. Only after the formation of the primitive streak is it determined which cells are going to be the actual embryo and which cells will be assigned to the extra-embryonic part (placenta). This view is held, for example, by the reproductive biologist Anne McLaren (1986: 11, 12, 22). She writes: "About sixteen days after fertilization, all the cells derived from the fertilized egg are finally committed to being either part of the individual embryo or outside of it." She also states that: "the embryo does not exist for the first two weeks after fertilization. It is formed from a tiny subset of the mass of cells generated during that period by the fertilized egg." And, "If one tries to trace back further than that [primitive streak] there is no longer a coherent entity. Instead there is a larger collection of cells, some of which are going to

take part in the subsequent development of the embryo and some of which aren't.... To me the point at which I began as a total whole individual human being was at the primitive streak, the formation of the embryo...".

A similar line of argument is represented by Clifford Grobstein (1988: 81/82), who writes that preembryos "are best regarded scientifically as a transitional stage between two major developmental landmarks – fertilization that establishes genetic individuality and the initial organization of a developmentally unitary individual."

Another reason for applying the term 'preembryo' is that the early embryo is not committed to developing into an individual embryo. Before the appearance of the primitive streak the early embryo has the capacity of twinning, or becoming more than one distinct individual. Also, two or more cleavage-stage embryos (morulae) can recombine and form a single chimera.

In their article *Before I was an Embryo, I was a Pre-Embryo: or was I?*, Jones and Telfer (1995) reject the above listed arguments for the use of the term 'preembryo' based on jointly biological and ethical grounds. In a first step, they present an argument for the significance of the extra-embryonic tissues (e.g. embryonic cells that will become the placenta). They start out with the following premise: "That the bulk of the pre-embryo will become extra-embryonic rather

than embryonic has biological and moral significance only if the extra-embryonic tissue can be shown to have no biological and moral significance" (p.41). By referring to the example of a person whose life is dependent on an artificial respirator, they point out that "the value ascribed to a person is conferred (for a time at least) upon that which directly sustains her life" (p.42). Because the embryo (and the fetus) cannot exist independently of the placenta, Jones and Telfer come to the conclusion that "whatever value is ascribed to the [embryo or fetus] must, by association, be ascribed to the [placenta] as long as *it is functioning to maintain the embryo-fetus*" (p.43). And, "*even though much of it is committed to the formation of extra-embryonic tissues, the whole of it is essential for the well-being, growth and further development of that particular prenatal individual*". There can be no future embryo and fetus without the extra-embryonic tissues. To compartmentalize the two as though this were not the case is to fail to do justice to the maternal-fetal environment" (p.43/44).

In other words, such a sharp distinction between 'preembryo' and 'embryo' seems to place the fertilized egg closer to the gametes before fertilization than to the embryo differentiated from the placenta. The main objection to this distinction is that it neglects the continuum which links the zygote with both the embryo at implantation and the fetus. By ascribing to the preembryo the potentiality to produce and the embryo the potentiality to become, the fact that the whole entity is significant for the development of a human being is ignored. What is relevant

though, both morally and biologically, is the whole, regardless of whether some part of it will or will not continue to exist after birth.

In a second step, Jones and Telfer question that the formation of the primitive streak as a developmental landmark actually possesses the biological significance which is frequently ascribed to it. They write that "the primitive streak occupies a place within a set of developmental events" and that it is "a transitory phenomenon, on its way to being transformed into more definite features of the early embryo." Then they claim that the primitive streak's biological significance "needs to be seen within a developmental context rather than as a sole organizer for an individual being's existence" (p.44).

Here, I would like to point out that individuality is regarded by some as ethically significant for the ascription of personhood. Although I agree that individuality is an essential property of persons with full moral standing, I believe that the formation of the primitive streak is a gradually and continuously occurring event and it is not possible to determine within the formation itself an accurate point of time where the embryo loses its totipotency.¹⁴ Moreover, even after the formation of the primitive streak the embryo cannot be regarded as an entity with full moral standing (arguments for this claim are seen in the following sections). Though the embryo's moral standing might be increased after the

¹⁴ Totipotent (or pluripotent) means that a cell is capable of developing into a complete organism or differentiating into any of its cells or tissues. The significance of this is that any cell of the cleavage-stage embryo can develop into a human being. The early embryo is not yet committed to developing into an individual.

formation of the primitive streak, it does not achieve the moral status of a person yet. In addition, there are other developmental events (e.g. appearance of brain waves) which increase a prelate's moral status. But I believe that none of these landmarks is decisive or marks a sharp distinction between moral standing and moral non-standing.

In a final step, Jones and Telfer point out that from a biological point of view, the developmental process has to be regarded as strictly continuous, making the establishment of any fixed landmarks within this process impossible. They write:

Any attempt to distinguish between clearly-delineated developmental stages, such as pre-embryo and embryo, has all the inherent problems of a developmental continuum. This is because the transition from one stage to the next is not instantaneous, while the later stage is totally dependent on the successful completion of the former stage. (p.45/46)

Additionally, the prefix 'pre' implies the existence of a morally relevant difference between these two developmental stages ('preembryo' versus 'embryo'). But this distinction cannot be justified. Jones and Telfer (1995) write that "the pluripotent nature or otherwise of cells tells us nothing about how it is right to treat the early embryo. Neither does the first appearance of the primitive streak tell us anything of moral significance" (p.46). Baylis (1990: 311) supports this view by saying that the use of the term 'preembryo' "might suggest an attempt to finesse some of the more difficult moral questions" (p.311). She

continues to use the term 'embryo' because she regards the embryonic development as a continuous process with each part being of equal importance.

In accordance with Jones and Telfer I reject the 'preembryo' terminology because I doubt that this term helps to clarify the scientific or ethical issues at the beginning of human life. Moreover, I think that 'preembryo' is a misleading term because, in my opinion, it generally does not seem to be used in a merely descriptive way, but rather, in a way which implies that before the embryo there was something of markedly less moral importance. Finally, even if we made use of the term 'preembryo' this would not change the fact that the completion of fertilization marks the beginning of a new human life.

Despite all these considerations the question about the moral status of the early embryo is not settled. After having explained exactly what the terms 'embryo' and 'fetus' stand for, I will resume discussing this issue in section 2.3.

2.2.2 The Term 'Embryo'

As is evident from the previous discussion of the term 'preembryo,' there is no universally recognized definition of the term 'embryo.' Most commonly it refers to the developing human entity from the beginning of the third week after fertilization until the end of the eighth week after fertilization, when head, face,

hands, and feet begin to be formed. At the beginning of the ninth week the term 'fetus' is then used instead.

Because I would like to avoid having to use a special term for the first 14 days after fertilization (argument for this, see section above), I will, in the context of this thesis, mainly use the term 'embryo.' Frequently, I will also talk about the early embryo because PID is performed 2 or 3 days after fertilization.

2.2.3 *The Term 'Fetus'*

As mentioned before, the end of the eighth week is usually regarded as the transition from embryo to fetus. By the beginning of the ninth week the developing human is technically (and, again, *arbitrarily*) designated a 'fetus.' This term signifies that the bodily form and the major structures are recognizable, although still quite immature in size, anatomical detail, and function.

For this thesis, the term 'fetus' and the moral status of the fetus will only be used in the context of selective abortion after PND. My use of the term 'fetus' is not meant to imply a moral difference as the distinction between 'preembryo' and 'embryo' would. The term 'fetus' is, as already pointed out above, arbitrary and is merely used in a descriptive way. The main focus of the thesis, though, will be on the preimplantation or IVF embryo, since this is the relevant developmental stage for PID.

2.3 Is the Human Embryo a Person?

The abortion debate, the discussion of embryo research in general, and techniques like IVF and PID in particular have raised the question about the moral status of the embryo and fetus. In the literature several categories of arguments for the determination of the moral status of the unborn have been put forward. In the following sections I will present the most common lines of argument on this issue. In the context of the potentiality argument, I will introduce the notion of degrees of potential (Singer & Dawson, 1990: 83). After having done this, I will proceed to utilize the information presented for, first, trying to clarify the moral status of the growing human being. Second, I will compare the moral status of the early embryo with the status of the human fetus. The results of this comparison will have implications toward whether PID has advantages to PND from the moral status point of view. Finally, I will discuss the implications of these thoughts in the context of research with human embryos.

2.3.1 Humanhood at Conception

The humanhood at conception argument holds that the embryo is, from the moment of conception entitled to protection because it is a human being with full moral status. In other words, it has a right to life, like any other human being. The argument supporting this view has two parts. First, it points to the fact that the egg and sperm combine to form a zygote with a new genotype that is

indisputably human. From this single cell all the different types of tissue and organs that make up a body develop. Fertilization therefore marks the beginning of a new human being. John Noonan (1970) expresses this the following way:

The positive argument for conception as the decisive moment of humanization is that at conception the new being receives the genetic code. It is this genetic information which determines his characteristics, which is the biological carrier of the possibility of human wisdom, which makes him a self-evolving being. A being with a genetic human code is man. (p.57)

The second part of the argument maintains that humanity is present from conception onwards. In other words, there is no event or change in the unborn that has sufficient moral significance to allow us to say that now we have a human being, but that before this event it was not human.

For those who believe that humanhood begins at conception, the discard of the embryo after PID, selective abortion, embryo research, and fetal research are all morally unacceptable practices. In other words, there is no moral difference between discarding an embryo and aborting a fetus, or killing a baby after it is born.

2.3.2 Graduality Arguments

Proponents of the graduality argument hold that the moral status and the moral rights of the prelate are increasing in the process of its development. It

follows that at conception, the embryo is not yet regarded as a human being with full moral status. The embryo (or fetus) acquires this status in the course of its development. In addition, a gradualist view implies that there are no milestones along the course of the embryonic or fetal development which have moral significance.

There are different versions of the view that the moral status of the unborn increases during gestation. Some versions are referred to as 'gradualist' and are based on the fact that the development of the pre-nate is regarded as gradual and continuous. Gillespie (1977), for example, holds such a view. In the context of the abortion debate, he argues that it is not possible to determine a point somewhere between conception and adulthood "at which one can draw a line and demarcate the morally right from the morally wrong abortions" (p.243). Instead, he uses examples like 'baldness' and 'poverty' to draw a parallel to 'personhood' and to show that within such continuums it is not possible to draw a line. He claims that "the rational thing to do is to treat such cases on a *comparative* basis: to say that A is poorer (balder) than B, and, in the abortion dispute, that small children are not full-fledged, responsible adults, that infants are further from adulthood than small children, and fetuses still further removed from adulthood than infants. Given our awareness of the spectrum from poverty to riches, from baldness to a full head of hair, and from conception to adulthood,

we can specify quite precisely where an individual falls along any of those spectrums. So precision is possible without drawing any lines ..." (p.239).

In section 2.4. I am going to present my own approach for the determination of the moral status of the unborn. This approach will differ from a mere gradualist view insofar as I will combine it with the notion of potential. In other words, during its development the prelate's moral status is continuously (but not linearly¹⁵) increasing, while at the same time, it is realizing more of its potential; thus, the degree of personhood is being changed.

2.3.3 Milestone Approach

In contrast to a gradualist approach, there are arguments which do allow for the identification of milestones. Within this kind of view, there have been various developmental landmarks proposed as determinants of the moral status of the unborn. Among these, the landmark most frequently proposed is that of the fourteenth day after fertilization (appearance of the primitive streak), because by this point in time the embryo has implanted into the uterus and it will subsequently undergo individual development.

¹⁵ There are developmental events (e.g. formation of the primitive streak) which seem to me more significant than others (e.g. division of a 2-cell aggregate into a 4-cell aggregate). One can therefore identify quantum leaps (but not fixed landmarks) where the prelate acquires, within the same developmental period of time, greater moral standing.

Another marker event often used as a determinant of moral status is the moment when the fetus has the ability to feel pain. This ability can be regarded as the most primitive form of conscious experience. Although the evaluation of pain in the fetus is difficult (pain is a subjective phenomenon and we do not have access to the fetus *in utero* to perform behavioral tests), research "seems to indicate that pain perception much earlier than the end of the second [gestational] trimester is highly unlikely" (Steinbock, 1992: 49). Such an approach has the consequence that a distinction can be made between sentient and non-sentient beings. Early human embryos would, if the ability to feel pain was used as the marker event, be treated as any other non-sentient organism, not possessing any moral standing.

2.3.3 *The Potentiality Argument*

Before I start presenting the potentiality argument, I would like to make the following preliminary remark, which I believe is important in light of the emergence of the cloning technique. It has been claimed that the potentiality argument is of no use since cloning is possible. Although this technique has not been applied (yet) on human cells, it in principle enables the development of a human being from basically any human cell. Before the advent of cloning, embryos (and gametes) were unlike any other human tissue in one crucial respect. They were the only entity possessing the potential to develop into (or in

the case of gametes, to contribute to the development of) a new human being. With the emergence of cloning, the embryo therefore loses its special status as the only entity with the potential to become a human being. The development of a human being is thus reduced to a matter of technical practicability.

For the analysis of PID versus PND and the use of the term potential in this specific context, the possibility of cloning will not be relevant because I will introduce the notion of degrees of potential. Within such a framework, the degree of potential to become a human being from a single human cell can be compared with that of the embryo. Without going into further detail, I would claim at this point that a single cell's potential to become a human being is small in comparison with the potential of the preimplantation embryo. This is due in part to the fact that the technical expenditures required to achieve the state of a viable embryo are for a single cell considerably higher than for the preimplantation embryo. Moreover, not only do the costs have to be taken into consideration but also the fact that through the process of cloning the natural function¹⁶ of a specific cell is completely changed. In other words, I think that a renal cell's function as determined by nature, for example, is to become part of a kidney. Its primary function is not that it should be turned artificially into a new human being. Therefore, as already mentioned, I believe that any human cell's potential (except that of gametes) to become a human being is markedly smaller

¹⁶ For me, 'natural function' is meant to express something that is *likely* to occur or that will happen *without interference*.

than the potential of the preimplantation embryo. This is because without external interference, such cells would never turn into a fully developed human organism, but would always and at most remain parts of it.

The presentation of the potentiality argument will mainly rely on the accounts on this argument by Peter Singer, Karen Dawson, and Stephen Buckle in Singer et al.'s (1990) *Embryo Experimentation*.

The introduction of Stephen Buckle's treatise of the potentiality argument contains a good summary of how the argument is generally understood. He writes:

[T]he argument holds that we should not interfere with, and perhaps should even assist, the development of the human fertilized egg because it already possesses the potential to be a fully self-conscious being; to be, that is, not merely a biologically human being (a human object), but a human subject. It is, potentially, just like us, so we cannot deny it any rights or other forms of protection that we accord ourselves. The argument holds that, although the fertilized egg is not just like us in possessing rationality, self-consciousness, etc., this is a difference which is not fundamental, because it is overcome in time through the normal course of events.... The fertilized egg is not 'just like us' only in the sense that it is not yet like us. Therefore, the argument concludes, we should not interfere with its natural development towards being a rational, self-conscious being. On its strongest interpretation, the argument is thought to establish that we should treat a potential human subject as if it were already an actual human subject. (p.91)

The potentiality argument has frequently been disputed because the potential to possess certain capacities is not the same as actually having or exercising them. Furthermore, it is argued that whatever a potential person is, it is not a person. Therefore, the argument from potential seems to confuse the capacity for developing certain characteristics with their actual possession.

Despite the dilemma just pointed out, Buckle argues that there are two kinds of reasons which could be advanced in support of the view that the capacity to develop morally significant characteristics is also morally significant. First, the capacities are significant "because it could be argued that it is precisely capacities ... which are morally significant [and] that moral behavior is a matter of respecting the capacities of other beings." Second, "because present capacities are (in the ideal case) future actualities, and because it could be argued that moral behavior is behavior which regards the consequences of actions, then our moral obligations regard not merely present actualities but also future actualities, and therefore present potentialities" (p.92/93). I agree with these reasons and, in addition, I endorse the view that the potential to become a person has some moral significance for ascribing an entity moral status. Nevertheless, the mere capacity to become a person in the future does not render an entity an actual person with full moral standing.

An additional point mentioned by Buckle is that both advocates and critics of the potentiality argument are often not clear about what they understand

potentiality to be. He says that "a number of recent accounts of potential regard it purely as a provisional prediction about future actualities." John Harris is cited as an example:

To say that the fertilized egg is a potential human being is just to say that if certain things happen to it (like implantation) and certain other things do not (like spontaneous abortion) it will eventually become a human being. (p.93)

Buckle claims that the word potential used in such a broad sense "is too indiscriminating to found, without further qualification, any moral argument." By broad sense he means that "potentiality is just possibility – whatever the entity in question can possibly become, or be transformed into, is its potential" (p.93). He writes: "An acorn in this sense is not merely a potential oak tree; it is also potential food, or humus, or whatever human ingenuity can make of it. In like manner, a fetus is not only a potential person, it is also a potential abortus, a potential experimental subject, even a potential meal for the dog. Because any entity has, in this very broad sense of the term, so many different potentials, and these potentials are concerned with states of affairs of sharply contrasting value, we can conclude that this sense is too indiscriminating to found, without further qualification, any *moral* argument" (p.93/94).

If we want to avoid the notion of potential as deprived of its moral significance, then potential cannot be understood simply as possibility. On the contrary, the potential of an entity is, as Buckle writes, "its power to develop in

certain ways" (p.94). In other words, "the central meaning of 'potentiality' is that of an object's potency" or power to develop in certain ways – the very ways which "it possesses in virtue of its specific constitution" (p.95).

One of the major problems of the potentiality argument is that it cannot convincingly establish the moral distinctiveness of the fertilized egg compared with the gametes. In other words, the argument from potential does not justifiably support the view that there is a relevant moral distinctiveness between the zygote and the unfertilized egg, the sperm, or – if the cloning technique is taken into account – any other human tissue.

In order to tackle this problem, I believe that the notion of degrees of potential is very helpful. In their article titled *IVF Technology and the Argument from Potential*, Singer and Dawson (1990) introduce this concept, which entails two interesting lines of thought.

The notion of degrees of potential will, combined with the graduality argument, be important for the alternative approach (see section 2.4.) for the determination of the moral status of the embryo and the fetus.

At the beginning of their article, Singer and Dawson claim that "the notion of potential may be relatively clear in the context of a naturally occurring process such as the development of an embryo inside a female body, [but] this notion becomes far more problematic when it is extended to a laboratory situation, in

which everything depends on our knowledge and skills, and on what we decide to do" (p.77).

Thereafter, they proceed to suggest, first, that the meaning of an entity's potential is dependent on the context in which this particular entity exists. The example they give is an embryo in a laboratory dish compared with an embryo in a woman's uterus. The IVF embryo cannot develop into a person unless there is a deliberate human act, namely the transfer to the uterus. Even then the chance that it will develop into a person is not very high (as we have already seen in section 1.1.). In contrast, if there is no deliberate human interference with the embryo in the uterus, it will more¹⁷ likely develop into a person.

Second, the potential of an entity also depends on the probability¹⁸ of the entity to develop in a specific way. Again, if we take the example of the *in vitro* and *in vivo* embryos and compare their probabilities of becoming a person, the probability of the embryo *in vivo* is undeniably higher than the one of the embryo *in vitro*.

Based on these considerations Singer and Dawson conclude "that potential ceases to be an all-or-nothing matter, and becomes a matter of degree" (p.83). Thus, they introduce the notion of degrees of potential.

¹⁷ The estimated chance of birth for an embryo that has implanted into the uterus is 46-60%, and the chance of a birth occurring increases to 85-90% after approximately six weeks of gestation (Singer & Dawson, 1990: 86)

¹⁸ Although Singer and Dawson do not mention this, I would like to point out that context and probability are not two completely separate things. Rather, they are interrelated – probability being very much dependent on the context.

If we accept the existence of degrees of potential, then we can establish a scale of degrees of potential for different entities. On this scale a zygote's degree of potential for becoming a person is markedly greater than the degree of the single egg or the sperm. The degree of potential of a fetus would also be greater compared with the one of an embryo. Here, it needs to be pointed out that, in my view, an entity's degree of potential has no absolute value, i.e. the determination of an entity's degree of potential is always in relation to the degree of potential of other entities.

In the next section I will try to show in which way I perceive the notion of degree of potential to be connected with the moral standing of a particular entity.

2.4 Alternative Approach – Potentiality and Graduality Combined

2.4.1 Increasing Moral Status during Gestation

If one accepts that the potential to become a person has at least some significance for ascribing an entity moral status, and if it is also accepted that potential is not an all-or-nothing matter, then the notion of degrees of potential is morally relevant as well. An important premise for this view is that an entity's moral status can admit of degrees and need not be a threshold concept. Although Singer and Dawson do not raise this subject, in my opinion the pre-nate's degree of potential for becoming a person differs at different points of time and development. Through gestation, the pre-nate realizes more and more

of its potential, thereby assuming different degrees of potential¹⁹. At the same time, the degree of personhood – and thus, the moral standing of the entity – is also increasing.

This view has considerable intuitive plausibility. In particular, this view is attractive because of its agreement with intuitions such as the following: abortion performed early in gestation is ethically less problematic than late abortion; fetuses near term have a moral standing that is close to (if not the same as) that of newborns; and infanticide is generally wrong.

At this point, I would like to briefly address the disputed issue of the moral relevance of intuitions or moral feelings. There are philosophers who question the moral significance of intuitions (Mayo, 1986: 43-47). They think that moral questions should be approached by appealing to some general ethical theory which has been established independent of referring to intuitions. One possible reason for this view is that moral feelings seem to depend very much upon what ethical principles were accepted by the society and the environment in which somebody was raised (Tooley, 1983: 25). An example I could think of is that some people 'experience' women to be inferior to men, or people of color to be inferior to whites. Although I acknowledge that intuitions are not unproblematic and certainly are prone to abuse, I do not agree with a complete rejection of moral intuitions or feelings. For I think that a morality which is radically

¹⁹ The unborn's probability for reaching the stage of birth is also progressively increasing during pregnancy (an indication of this, for example, is that the chance for miscarriage is decreasing).

disconnected from our experiences, emotions, and deepest feelings cannot be action guiding.

The view that the moral standing of the prelate is increasing during its development has more than just intuitive plausibility. It is also supported by other observations – like the changing physical appearance of the unborn – and additional characteristics such as sentience or viability, which appear at some point in the course of development. If we compare, for example, the physical appearance of a cleavage-stage embryo with the appearance of a fetus near term, then it can be definitively said that the embryo cannot even be recognized as belonging to the human species, whereas the advanced fetus clearly looks like a human being. The biologist Clifford Grobstein (1988) expresses this fact the following way:

Biologically, the preembryo and the newborn are so different – separated by nine months of development but a billion years of evolution – that it seems almost bizarre to think of them having the same moral status. (p.76)

During its growth the unborn is developing characteristics such as sentience and viability, which as characteristics generally indicative of personhood, increase its moral standing (Sumner, 1981; Zaitchik, 1980).

2.4.2 Where Do We Draw the Line?

Although the notion of degrees of potential is helpful in comparing the moral status of clearly delineated stages of development such as early embryo and fetus, it does not allow a determination of the status of the unborn in general. However, despite its potential to develop into a person and despite a gradual increasing moral standing, I believe that the growing human being does not have full moral standing because it lacks certain qualities (e.g., consciousness, self-consciousness, reasoning, etc.). The question of at which point in time and development the unborn acquires full moral standing – if at all – remains open. And, in my opinion, it will not be possible to unambiguously solve this problem.

Rather than focusing exclusively on the question of whether the unborn has full moral standing and the right to life which is included in this notion, I think that the debate on how we should treat the prelate (embryo and fetus) should be broadened by another aspect. Namely, it should also be conducted in terms of respect for life. Rather than focusing solely on the unborn's full moral standing, we should not forget that it is an actual living being. Focusing on the full moral status only seems to me to be too narrow a conception of morality. A wider conception of morality would include care and consideration for other living beings. In other words, even if the prelate lacks full moral status, we may still have respect for its life because it actually is a developing form of human life and a potential human being. At this point I would like to briefly address what the

notion of respect for life entails. In contrast to full moral status, the notion of respect for life does not entail rights. In other words, an entity's life may be respected but it does not inherently possess rights. As I will mention below, respect for life can be given to non-human animals, which are also living entities.

2.4.3 Conclusions for PID versus PND

Since the comparison between PID and PND is my major concern in this thesis, I would like to apply the acquired information to this problem. The notion of degrees of potential is very useful for an ethical assessment of the discard of a preimplantation embryo after PID compared with the selective abortion of a fetus after PND. The degree of potential to become a person is undeniably higher for the fetus than it is for the preimplantation embryo, because the IVF embryo cannot survive without a deliberate human intervention. Nevertheless, it does not follow that the fetus has the moral status of a human subject; if this were so, abortions in general (without substantial reasons or weighty considerations on the woman's side) would have to be rejected. Provided that our argument is based on the determination of an entity's degree of potential, this leads to the conclusion that PID and a possible discard of the preimplantation embryo seem, as far as the moral status of the entity is concerned, to be preferable to PND followed by selective abortion.

The question, however, of whether or to what extent we ascribe the *in vitro* embryo moral standing remains unanswered. In the context of research with human embryos I will try to elucidate this issue in more detail.

2.5 Research with Human Embryos

Since PID is a newly developing technique, which needs to be improved, the use of research embryos and embryos with which one can practice the technique is inevitable. In addition to that, IVF, the pre-condition for PID, usually involves the creation of so-called 'surplus' or 'spare' embryos. These are embryos remaining after IVF treatment because they are not transferred into the uterus. The reason is that either they show a pathological genetic test result or there were simply too many embryos created by superovulation/fertilization²⁰ and not all or them could be placed into the woman's uterus.

There are several important questions on embryo research and the use of embryos raised in the context of PID. First, do preimplantation embryos have moral standing? Could their use in research be rejected on these grounds? Second, under the assumption that preimplantation embryos are not persons

²⁰ From an ethical perspective these are very different cases. One might make a case for discarding 'diseased' embryos on the basis of the welfare of the potential child (although this would have to be argued for because not all conditions are clearly such that it would be better not to be born). Nevertheless, this sort of argument is certainly not possible for 'surplus' embryos, especially when one considers the possibility that they might be given to an infertile couple who cannot produce their own embryos for implantation and/or adoption after gestation in a surrogate.

with full moral status, do they still deserve respect for their life? Third, it is often claimed that there is a moral difference between research using surplus embryos and research with embryos that were exclusively created for research purposes. Is there, indeed, a morally relevant distinction? In the following pages I will discuss these questions.

Before I begin with the actual discussion, I would like to point out that research with human embryos can be classified as being either therapeutic or non-therapeutic. The latter has no benefit for the subject of research and it is intended to help others. Therapeutic research entails that the performed treatment, though still experimental, is carried with the goal of benefiting the future child.²¹ At the moment, all research done on embryos falls into the category of non-therapeutic research, not promoting the health nor extending the life of the individual embryo being used. This aspect of embryo research will not be discussed further, because it would go far beyond the scope of this thesis.

Based on the analysis of the moral status of the human embryo in section 2.3. and 2.4., it can be said the preimplantation or *in vitro* embryos cannot be

²¹ Besides these two types of embryo research which focus on the *in vitro* embryo only, there are more complex categories that include embryo and fetus *in vivo*: (1) research or treatment which would be therapeutic for the mother and at the same time be therapeutic for the embryo or fetus and (2) research or treatment which would only be therapeutic for the mother but presumably not for embryo or fetus (for example, a case where the mother needs to be treated for cervical cancer and the treatment could affect the unborn's state of health).

regarded as persons with a full moral standing. If they had full moral standing and the same right to life as any other person, then discarding them or using them for research purposes would be morally wrong.

The reasons for not granting *in vitro* embryos full moral standing are manifold. First, their physical appearance does not allow an assignment of belonging to the human species. Second, preimplantation embryos are definitively not sentient because they lack even the precursor of a nervous system. Third, they are not viable.²² Finally, their potential to become a human being depends on the knowledge and skills of the researchers and on what they decide to do. Moreover, the IVF embryo's potential for developing into a person is low because the probability of this happening is also negligible.

Even if they lack full moral status, preimplantation embryos may still be given respect for life. As mentioned in section 2.4.2., respect for life would entail the notions of care and consideration for other living beings. Without further discussing this issue, I would like to point out that respect for life can also be given to non-human animals, which are also living entities. Because of the fact

²² The characteristics I mention here are generally considered in the literature (Strong, 1997) to be relevant for the determination of the moral status of the prelate. Another characteristic, namely the possession of a human genetic code, I do not mention here because from my previous discussion, it follows that the mere possession of a human genetic code does not endow an entity with full moral standing. Moreover, since my discussion deals only with human embryos and fetuses, there seems to be no need to particularly emphasize this feature. Other characteristics which are usually important for the ascription for personhood, such as consciousness, self-consciousness, reasoning, self-motivated activity, or language, are completely left out because they are not applicable for the embryo and fetus.

that the embryo is an actually living entity (i.e. a developing form of human life and still a potential human being), I think that the preimplantation embryo should warrant serious moral consideration and respect. The preimplantation embryo merits more care than other human tissue, unfertilized eggs or sperm, or animal embryos. In other words, because of its worth of being potentially human, the preimplantation embryo is deserving of respect. This is reason enough not to treat the embryo as a mere commodity or convenient tool for research. At the same time, we should bear in mind that respect for humanity is not displayed when non-sentient *in vitro* embryos are protected at the expense of the vital human interests of people with full moral standing. I would therefore approve of research that offers genuine promise of contributing to vital human interests. Examples which would satisfy this requirement may be embryo research for understanding, preventing, and treating cancer, and research aimed at studying and treating genetic disease. In contrast, I would disapprove of the use of embryos for unnecessary experiments (e.g. basic research where application is very remote) or of their use for commercial purposes (e.g. research on cosmetics).

Finally, I would like to address the problem of whether there is a moral difference between a surplus embryo remaining after an IVF/PID procedure and an embryo deliberately engineered for purposes of conducting research. Based

on the considerations made in the previous pages, I will examine this question under the assumption that the preimplantation embryo is not yet a human being with full moral status – though it is a human entity at a very early developmental stage.

If one focuses on the ontology of the embryo itself, then it can be said that both the surplus embryo and the embryo created for research purposes have the same moral status. In other words, if rights and obligations derive from the status of the embryo, then two *in vitro* embryos, one especially engineered for research, the other remaining after IVF (or PID), have the same moral status. It follows that if it is permissible to use surplus embryos for research, it is then also permissible to use deliberately created embryos at a similar stage of development.

Since spare embryos cannot be distinguished from research embryos from the moral status point of view, some authors have invoked other grounds for making a distinction. Some argue that a line must be drawn between surplus embryos and research embryos in order to express our respect for and commitment to the value of life. Others base their distinction on the belief that embryos should only be created for procreative ends. In this case unneeded embryos may later be used for research (provided that the mother/parents give consent for such use). In her article on research embryos, Carol Tauer (1997b) has carefully analyzed and rejected both approaches. With reference to the first

approach, which is meant to draw a line between spare and research embryos, Tauer writes that "the line could be drawn at many other places" and "there are essentially no criteria for drawing a line that simply expresses 'respect' " (p.174). While she believes that we actually could choose to adopt a line that symbolizes an expression for respect, she claims that "there is no logical reason why the line must be drawn just precisely between the use of 'spare' embryos and the use of research embryos." Moreover, "it [the chosen line of distinction] is only as valid in expressing 'respect' as its interpreters find it to be" (p.174). The second approach bases the distinction between the use of spare embryos and the creation of research embryos on the belief that embryos should be brought into existence only for procreative ends and that the creation of human life for any other reason is unethical. In her analysis of this argument Tauer writes, in a first step, "that it is unclear what grounds there are for the assumption that a zygote may be brought into existence only for a procreative purpose, that is, with the intent that it become an actual person. Before the zygote existed, it had no right or claim to exist (for any purpose), nor not to exist (for any purpose)" (p.175). Second, Tauer suggest that there "might be some sort of natural law argument at work" (p.175) in support of the view that embryos should only be created for procreative reasons. Referring to the Roman Catholic version of natural law theory, she concludes that "the presence of any embryos in the laboratory, even those intended for transfer, represents a violation of the moral law" (p.175). A

third argument that Tauer presents presupposes the Kantian claim that we ought never to treat others merely as means to our own ends. The "initial procreative purpose is [thus] supposed to insure that no embryo is treated solely as means to the ends of others" (p.176). Tauer rejects this type of reasoning because of the fact that "the typical IVF scenario belies this interpretation. When a large number of ova are retrieved and fertilized in the hope that one will implant after transfer, then most of the fertilized eggs do seem to have the role of means to the future development of one or two others" (p.176). In agreement with Tauer, I also believe that these arguments which try to draw a line separating surplus embryos from embryos created for research purposes are not convincing. Again, it is either allowable to do research with both kinds of embryos or it is not allowable with either.

Nevertheless, as already mentioned before, I believe that *in vitro* embryos do deserve respect for life and thus should not be treated as a commodity or as a convenient research tool. Because IVF treatments involve a tendency to create surplus embryos – with the goal to counter the low implantation rate – I think that the IVF practice itself should be carefully regulated. The number of spare embryos produced should be limited and they should only be used for projects where the expected benefit from research is significant. In order to prevent embryos from becoming a mere commodity, the buying and selling of eggs,

sperm, and embryos should be (and in most countries currently is) forbidden. In addition, only women who are undergoing surgery for their own health or treatment should be allowed to donate eggs. The reason for this restriction is that if a woman does not donate eggs for her own health or treatment, there exists a risk that ova donation will become commercialized and that ova will be turned into a mere commodity. These practices (aiming for economic advantages) would themselves entail the risks of exploitation of both healthy egg donors and infertile women. Fertile women may be vulnerable to exploitation because of economic reasons. Driven by financial or other compensation, disadvantaged women could become compelled to donate their eggs and subject themselves to the serious risks of ova retrieval.²³ Infertile women, on the other hand, who are anxious about their reproductive status and in addition may feel dependent on their physicians may be vulnerable to pressure from their physicians to donate eggs for research. It is not uncommon that IVF clinics have an interest in using spare or surplus embryos which are not transferred into the uterus for research. This could lead to undue pressure on the woman.

²³ In this context, I consider the following finding presented by Alpers and Lo (1995: 41/42) to be particularly interesting. They write "that the NIH Panel noted that IVF programs find less demand for ova from economically disadvantaged women or women of color. Although the eggs of these vulnerable women are not valued for reproductive purposes, they are valuable for research. The Panel was concerned that financial compensation to women who provide eggs for clinical research could induce disadvantaged women to assume the risk of ova retrieval in order to sell their eggs for research."

3 SELECTION, CHOICE, AND QUALITY OF LIFE

3.1 *In Vivo versus In Vitro*

The emergence of new reproductive technologies such as *in vitro* fertilization and preimplantation diagnosis requires that we not only look at the issue of the moral status of the prelate but also at the aspect of selection.

In the laboratory setting, not only women (and men) who are directly and emotionally affected are involved, but also scientists whose goal it is to gain information and make progress in their research. In this setting embryos are outside of the female body and are thus placed in a particularly vulnerable situation. In cases where a genetic disease is suspected, the relationship between the embryo *in vitro* and a woman desiring a child differs substantially from the relationship to the embryo *in vivo*. Here, the embryo is embedded in the female body and there is an intimate situation of conflict between the pregnant woman and the embryo. The embryo in the laboratory, in contrast, is not directly bound to the woman – their relation is a physically remote or detached one. Embryos *in vitro* are examined and selected independently of the woman who will potentially bear them. A change from the *in vivo* (PND) to the *in vitro* (PID) setting radically alters the interpersonal framework. The intimate encounter between the pregnant woman and the unborn is replaced by a detached, rational, and prospective way of thinking.

In the laboratory setting, the question about the moral status of the embryo is only helpful insofar as we are willing to ascribe the embryo *in vitro* a full right to life. In this case, the question of selection does not arise because after fertilization has occurred, all *in vitro* embryos subsequently have to be transferred to the woman (women). If the *in vitro* embryo is endowed with only a limited moral status, questions do arise about which embryo(s) is (are) to be selected for implantation and based upon what grounds. As is evident, the problem of selection cannot be solved by recourse to the moral status of the embryo and thus needs to be discussed separately. If we make a comparison between a potentially diseased embryo – specifically, one actually possessing the capacity for becoming viable if it is transferred to the uterus²⁴ – and an embryo which is disease free, then both embryos have the same actual moral status, independent of whether they will have a disease or not. If this were not the case, moral status would be ascribed, not according to gradual development and/or (degrees of) potentiality, but based on a child's (expected) future quality of life. In other words, the potential of developing into a human being would be substituted by the potential of future quality of life.

²⁴ When I talk about diseased embryos in this context, I do not have embryos with severe genetic anomalies in mind, because these embryos seem to be more at risk for spontaneous abortion. At the same embryonic stage of development, their chances for being born alive are diminished compared to anomaly-free embryos. Therefore, their moral status (based on potential) can also be assumed to be diminished. What I have in mind are embryos that are carriers of genetic aberrations not influencing their state of health and embryos that are susceptible to multifactorial disorders.

Although quality of life considerations can play a role in the selection process (especially in cases where the diseased newborn will not be able to survive or when its chances for survival are significantly diminished), in my opinion, it is rather problematic to select *in vitro* embryos for implantation based on their presumed quality of life.²⁵ This is particularly problematic when selection is not justified by whether the future child will suffer from a disease or not, but when selection is based on information about the embryo which has nothing to do with the future child's state of health. I especially have in mind sex selection (in the absence of sex-linked genetic diseases) and selection resting on genetic aberrations that have no direct implications for the future child's physical health, but which can be a risk for the child's offspring (i.e. the future child could be a carrier of a recessively inherited disease).

Of course, the question of how we deal with genetic information about the embryo which has no implications for the future child's health also arises in the context of PND. Nevertheless, in contrast to the *in vivo* situation, this problem seems to me to be much more prominent in the *in vitro* setting. This is because in the laboratory setting the relation of the embryo and of the woman who will

²⁵ Predictions about quality of life can be difficult because quality of life is in many cases an unspecific and individually dependent notion. I will use the example of the Sickle cell trait to illustrate this. Let us say that a person who is a carrier of the Sickle cell trait wants to become a professional athlete. She needs to be able to compete at high altitudes, and her trait might have a negative impact on this. This person would probably perceive her carrier status as something which negatively impacts her quality of life. Another person with the same trait, on the other hand, could be positively affected since because of this trait she would have some degree of resistance to malaria. A third person, finally, might not sense any impact on her quality of life.

potentially bear it is disconnected and detached, making an intimate encounter between the woman and her future child difficult. The laboratory setting seems to me much more prone to a way of selecting embryos where predominantly seemingly 'perfect' embryos will be chosen for implantation. Embryos which do not fulfill certain expectations or criteria will only be implanted unless there are no other compelling reasons. One possible reason for implanting less than 'perfect' embryos might be that women/couples undergoing IVF and PID would want to increase their chances for achieving a pregnancy by implanting as many embryos as possible in this IVF procedure in order to avoid having to pay for further IVF procedures.

3.2 *Choice and Autonomy*

The incentive for both PND and PID is the wish of the prospective parents to have a healthy child. Nevertheless, from the moral point of view these diagnostic methods differ in a crucial respect. At the time when the genetic test is performed and when the results are known, in PND there arises a genuine moral conflict between the interests of the pregnant woman and the survival of the fetus. In PID, on the contrary, such a conflict is not as much an issue. Here, the process of making a decision about whether to keep the child-to-be is severed from the interpretation of the test results. In other words, women (and of course all other people involved in the decisionmaking process, namely the prospective father,

the physicians, and the scientists performing the tests) who make use of PID have in most cases already decided at the very beginning that only disease free embryos will be implanted and get the chance to develop into human beings. In addition, in the PID setting, a careful assessment of the test results, of the conflict of interests, and of the pros and cons of a particular course of action is almost impossible because (for reasons of survival) embryos need to be implanted into the uterus within a few hours.²⁶ In such a setting, it seems unavoidable that only embryos seemingly possessing the best qualities are chosen for implantation.

As we have already seen, genetic analysis of embryonic cells enables more than just the detection of severe monogenetic disorders which have direct implications for the future child's health. PID also provides the means to predict characteristics like gender, carrier status, or susceptibility for multifactorial disorders such as diabetes, hypertension, or asthma.

For prospective parents this means that they have to face increasingly complex decisions which can go far beyond questions about wanting to avoid the birth of a child with a serious or life-threatening disease. We can therefore say that PID, on the one hand, broadens the range of choices that parents can make about their future offspring. On the other hand, however, at the same time they

²⁶ I am aware that these issues could be discussed prospectively in a hypothetical way, but I still think that there may be limitations to a careful assessment, because analyses and assessments of actual results are not the same as analyzing and making choices based on hypothetical results.

have to accept a loss of decisionmaking autonomy. In cases where physicians and researchers detect a faulty gene in the embryo, it is automatically sorted out. Because of the emotional detachment in the laboratory setting, it is much easier to accept the loss of an embryo. Moreover, the direct moral responsibility and parts of the decisionmaking process are ordinarily placed in the hands of the physicians and researchers. In my opinion, this is mainly due to the procedural framework of PID. Unless the parents deliberately leave it up to the physicians and researchers to make all the choices (in which case they would be exercising autonomy at this stage, but not later when the choice is made), it seems to me that the parental decisionmaking autonomy is actually limited. This is because the physicians and researchers are the ones performing the selecting procedures on the embryos. In doing this, and here I agree with Veatch (1988: 51) on what he calls the *Engineering Model*, the physician and researcher "cannot logically be value-free." Even if they try to give the parents as comprehensive information as possible, there are limits insofar as they themselves make decisions and choices about the extent of the provided information and in what way this information will be conveyed. Although PID can alleviate a woman's or couple's emotional stress, which is caused directly by a situation of conflict in conventional prenatal diagnosis, women or couples making use of PID must be aware that they have to give up moral responsibility and that they lose some of their autonomy.

4 PID AS AN ALTERNATIVE TO SELECTIVE ABORTION

As I have already mentioned in the introduction, PID is regarded as an alternative to selective abortion after amniocentesis or CVS. As many studies have shown, selective abortion is a morally and psychologically troubling procedure for women. In the following pages I am going to compare the moral and ethical differences between selective abortion following PND and the discard of the embryo after IVF and PID.

4.1 *Setting the Stage*

It is important for the following discussion to keep in mind that both selective abortion after PND and the discard of the embryo after PID are performed on the basis of the genetic characteristics of the fetus or the embryo. A decision to perform either of these two forms of abortion after a 'wanted' pregnancy differs from an abortion following an unplanned or unwanted pregnancy.

The issues of choice in the context of prenatal diagnosis seem to me rather different from the issues in the classic abortion debate. Although I am aware that women can have various responses to the termination of a pregnancy, and that it is not unproblematic to make general claims about women's experiences with and feelings toward abortion, I think that, in many cases, women tend to perceive an abortion after an unwanted or unplanned pregnancy differently from one which follows a wanted pregnancy. In the situation of an unwanted

pregnancy, the woman chooses to end the pregnancy because she does not want to bear a child. The woman does not really identify herself as a mother, nor does she cherish the pregnancy as the bringing of a baby. In this case, the mother's interest in avoiding the burdens of pregnancy and motherhood outweighs the (potential) life of the unborn. By contrast, when a woman chooses to terminate a wanted pregnancy, she does so because she does not want to bear this *particular* child. In this case, the hereditary or congenital condition of the fetus is regarded as representing a sufficient burden to the woman (or family) to justify selective abortion. In such a situation, selective abortion would mean for most women the loss of a baby which was clearly desired and wanted.

The introduction of preimplantation diagnosis enables prenatal diagnosis at a much earlier stage, thus avoiding late selective abortions. PID therefore solves some of the problems inherent in late selective abortion. But this does not mean it has no problems of its own. The following discussion will try to elucidate some of the ethical issues having emerged in the context of the advent of PID.

4.2 *The Abortion Replacement Argument*

As I have already briefly spoken of in the introduction, one of the most frequently asserted benefits of preimplantation diagnosis is that it constitutes a replacement for abortion. This line of justification specifically places PID in

relation to prenatal diagnosis of the fetus. The claim is that while both types of diagnosis entail the same function and goal, namely the diagnosis of genetic 'abnormality,' the advantage of PID is that it is performed before implantation into the uterus, thereby obviating the need for pregnancy termination by selective abortion. According to this view, selective abortion is perceived as a traumatic experience for women and preimplantation diagnosis is regarded as a way of eliminating such a trauma. The following passages illustrate this. Robertson (1991) writes:

The ability to obtain genetic information about human gametes and preembryos offers an important option to couples at risk for offspring with a genetic disease. Rather than aborting an already established pregnancy after prenatal diagnosis, a couple at risk could undergo IVF and transfer only embryos free of the genetic disorder of concern. (p.253)

And McLaren (1986):

David Weatherall asked what the benefit would be if these diagnoses could be made before implantation on *in vitro* material. Infertile couples who are at high risk from some genetic disease or chromosomal disorder would certainly benefit. We are not necessarily envisaging people having IVF in order to be diagnosed, but it must be a great anguish for an infertile couple to get finally pregnant and then to have the pregnancy terminated because the baby is affected. (p.104)

Another perceived benefit is that PID obviates the need to terminate a fetus.

Williamson (1986), for example, writes:

There are still many women particularly from the group who object to abortion, who would prefer antenatal diagnosis even earlier in pregnancy. There is a real demand for diagnosis of affected fetuses during the preimplantation stages of pregnancy, particularly after IVF. (p.112)

Particularly the claim that regards selective abortion to be more traumatic than the discard of an embryo after IVF and PID needs to be critically examined. The depiction of PID as a neutral or beneficial procedure is, in my opinion, wrong. The fact that PID necessitates that women undergo IVF treatments is obscured. Moreover, it is also obscured that (in case of a pathological genetic test result) a feeling of loss can be experienced, even though it is 'just' a loss of an embryo.

As we have seen in the introduction, IVF is a very extensive and invasive form of treatment, and a woman could perceive it as just as traumatic as the process of selective abortion. Certainly, both ways of pregnancy termination can be highly traumatic for the woman experiencing the procedure, and it should be left to the particular woman in her specific situation which approach she would favor. It would definitely be wrong to regard either approach as *a priori* preferable.

Furthermore, it is debatable whether the termination (i.e. not implanting the embryo) of a wanted prospect of pregnancy after a woman has undergone the difficult process of IVF is always less traumatic than the termination of an established and desired pregnancy by selective abortion. This certainly is, in

large measure, an empirical question. Since preimplantation diagnosis has only recently been introduced into the area of prenatal diagnosis, there are no data available on these issues. Therefore, I believe that empirical research is inevitable and that guidelines should be developed on the basis of respective findings. It seems to me problematic to leave this sort of determination to the woman. How, for example, can she know, in advance, whether she will experience feelings of guilt afterwards as a result of an embryo-discard?

Finally, it is important to point out that, contrary to the implications of the abortion replacement argument, it is not necessarily the case that PID avoids the termination of pregnancy by selective abortion. At the present stage of its technical development, PID is not accurate enough to ensure diagnostic test results which are sufficiently safe. If a woman wants to be sure that the test results obtained by PID are reliable, she still needs to have, at a later stage of gestation, either amniocentesis or CVS followed by PND. Therefore, in spite of what its proponents often point out, preimplantation diagnosis cannot avoid the issue of late pregnancy termination in all cases; if anything, PID can only reduce the number of selective abortions.

Both amniocentesis and CVS involve the risk of inducing miscarriage and PID, as we have seen, does not render the use of conventional prenatal diagnosis superfluous. Therefore, the risk of causing a miscarriage by PND

remains, even if PID has been performed as the initial step. After having undergone the difficult, physically demanding, and costly process of IVF, a miscarriage caused by PND would certainly be experienced by the woman as extraordinarily traumatic. This aspect of PID should certainly not be forgotten, even if one belongs to the camp of ardent supporters of this diagnostic method.

4.3 The Reassurance Argument

A commonly used argument for performing prenatal diagnosis as early as possible is that an early diagnosis provides means of reassuring parents (particularly those who are carriers of a genetic disease) that their child will be 'normal.' Gail Vines (1989), for example, holds this view:

The goal of "preimplantation diagnosis" is to give couples known to be at risk of passing on a severe genetic disease the option of having their embryos screened in the laboratory. This procedure would enable the woman to begin the pregnancy knowing that the embryo would escape the disease. (p.49/50)

Conventional prenatal testing is done either around the sixteenth week of gestation (amniocentesis) or between the eighth and tenth weeks (CVS). This places the pregnant woman in a peculiar and stressful psychological situation. On the one hand, she is committed to this pregnancy and the fetus; on the other hand, she is not, because she is prepared to abort the fetus in case the genetic testing reveals a pathological result. Barbara Katz Rothman (1986: 6/7) calls this situation "tentative pregnancy." According to its proponents, preimplantation

diagnosis would not raise any concern about tentative pregnancies since the embryos are created *in vitro* and the diseased ones are not transferred into the woman's uterus. Müller (1998) makes the argument this way:

PID has a number of obvious advantages: only non-affected embryos are transferred to the woman's uterus; no abortion is needed in the event of a pathological result, and there is no need to begin what amounts to a pregnancy on probation as is the case if the health of the fetus has to be determined by conventional PND. After a PID examination, a woman can accept her future child from the beginning of the pregnancy. She does not have to hold back her feelings towards it until the 10th or even 18th week of gestation when it has been established whether it will be healthy or not, i.e. whether it will be aborted. (p.281)

As we have seen in the discussion of the abortion replacement argument, PID is at the present stage of development a method that is not accurate enough. Hence, the use of PID does not render prenatal diagnosis by amniocentesis or CVS unnecessary. The argument in favor of PID presented above is therefore flawed. PID does not, as claimed, reassure the prospective parents that the embryo does not have a genetic abnormality thus avoiding the situation of a tentative pregnancy. Since the only embryos implanted are the ones which are seemingly disease free, PID can just alleviate – but never circumvent – the pregnant woman's stressful psychological situation.

4.4 Technological Limits

Apart from possible ethical reservations against the use of IVF and PID, there are also some technical problems associated with these techniques. Without going into too much detail, I would like to briefly outline these because I believe that knowledge of this information is important for being able to make a genuinely informed choice between the use of PID and PND.

First, IVF exhibits a poor success rate (see section 1.1.). In addition, there are several medical risks for the woman undergoing this rather mechanical, invasive, and physically demanding procedure. Another aspect possibly favoring PND is that prospective parents could perceive a high-tech form of conception like IVF as less appealing compared to conception by sexual intercourse. Second, several reports have shown that misdiagnosis is a recurrent problem at the preimplantation stage. At the moment, the accuracy of conventional prenatal diagnosis is still considerably higher. Third, another concern is the safety of IVF and PID for the developing embryo (particularly the removal of one or two blastomeres by biopsy). Too few children have been born so far to definitely know whether this procedure will have any long-term side effects. Finally, from the cost-effective point of view, IVF combined with PID is a more expensive procedure compared with 'natural' conception followed by PND and a possible selective abortion.

5 PID VERSUS PND – SUMMARY AND CONCLUSION

The first major part of this thesis was devoted to the question of whether the human embryo and fetus can be regarded as persons. In the course of the analysis of their moral status, I introduced the notion of degrees of potential. Based on the determination of an entity's degree of potential I came to the conclusion that the (preimplantation) embryo's degree of potential is lower than the fetus's. For an assessment of PID *versus* PND this means that a discard of the preimplantation embryo after PID should be given preference to PND followed by selective abortion. Nevertheless, from this it should not be inferred that the fetus, at the point in time when PND is usually performed, already has full moral standing. It just means that the fetus has a higher moral standing in comparison with the preimplantation embryo. Therefore, selective abortion can also not be rejected based on arguments relying on the moral status of the fetus.

In the second major part of the thesis I tried to identify and present a few problems arising in the context of PID. Among these are the problem of selection and quality of life, the moral detachment from the embryo caused by the *in vitro* setting, and the woman's or couple's loss of autonomy. Thereafter, I analyzed the two arguments most frequently put forward in favor of PID – namely, the abortion replacement argument and the reassurance argument. After having done this, I briefly presented the technological limits of IVF and PID.

From the analysis of the issues presented above, it cannot be unambiguously determined which course of action should be taken by couples who are carriers of a genetic disease and who want to prevent passing on the disease to their offspring. Neither the higher moral status of the fetus compared with the preimplantation embryo nor the abortion replacement and reassurance arguments seem to me convincing enough to favor or exclude the use of either method. In addition, the drawbacks of the *in vitro* setting associated with PID which I have presented have to be regarded as merely negative and questionable aspects of this method; none of these aspects, however, can be decisive toward rejecting or even forbidding the use of PID.

In my opinion, the choice of whether a couple decides to make use of PID or PND has to be made and evaluated on an individual basis according to the particular situation and previous experiences of the couple. Since women are the ones who are mainly affected by either procedure, they should primarily decide which course of action will be taken. I believe that it is absolutely necessary to ensure that every woman (who wants to choose between PID and PND) – as an individual, not as a couple – can make a genuinely informed and autonomous choice. In order to be able to do so they need to be given adequate, honest, and comprehensive information and support, which are embedded in and related to

the context of the personal and individual situation of the affected woman. It would definitely be wrong to deem either method as *a priori* more favorable.

As already mentioned, I do not think that the higher moral standing of the fetus compared with the preimplantation embryo can outweigh a woman's interest and wishes. The common arguments favoring PID are also not convincing enough to serve as a sound basis on which the use of PID over PND could be grounded.

Finally, I would like to present a case which I believe could best be regarded as a paradigm situation for the use of PID. The brief case description is given by Penketh (1993: 84): "Another woman who watched her brother die of Duchenne muscular dystrophy was shown to be a carrier. During two marriages, five male pregnancies were terminated, two after amniocentesis and three after CVS."

Nevertheless, a lot of cases where PID and PND are or will be at issue are not that extreme. A careful analysis, taking the individual and particular situation of the affected woman or couple into serious account, is therefore essential.

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