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WHEN DO HUMAN BEINGS BEGIN? SCIENTIFIC MYTHS AND SCIENTIFIC FACTS

by Dianne N. Irving

I. Introduction

The question as to when a human *being* begins is strictly a scientific question, and should be answered by human embryologists—not by philosophers, bioethicists, theologians, politicians, x-ray technicians, movie stars, or obstetricians and gynecologists. The question as to when a human *person* begins is a philosophical question. Current discussions on abortion, human embryo research (including cloning, stem cell research, and the formation of mixed-species chimeras), and the use of abortifacients involve specific claims as to when the life of every human being begins. If the "science" used to ground these various discussions is incorrect, then any conclusions will be rendered groundless and invalid. The purpose of this article is to focus primarily on a sampling of the "scientific" myths, and on the objective scientific facts that ought to ground these discussions. At least it will clarify what the actual international consensus of human embryologists is with regard to this relatively simple scientific question. In the final section, I will also address some "scientific" myths that have caused much confusion within the philosophical discussions on "personhood."

II. When does a human *being* begin?

Getting a handle on just a few basic human embryological terms accurately can considerably clarify the drastic difference between the "scientific" myths that are currently circulating, and the actual objective scientific facts. This would include such basic terms as: "gametogenesis," "oogenesis," "spermatogenesis," "fertilization," "zygote," "embryo," and "blastocyst." Only brief scientific descriptions will be given here for these terms. Further, more complicated, details can be obtained by investigating any well-established human embryology textbook in the library, such as some of those referenced below. Please note that the scientific facts presented here are not simply a matter of my own opinion. They are

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direct quotes and references from some of the most highly respected human embryology textbooks, and represent a consensus of human embryologists internationally.

A. Basic human embryological facts

To begin with, scientifically something very radical occurs between the processes of gametogenesis and fertilization—the change from a simple *part* of one human being (i.e., a sperm) and a simple *part* of another human being (i.e., an oocyte—usually referred to as an "ovum" or "egg"), which simply possess "human life", to a new, genetically unique, newly existing, individual, whole living human *being* (an embryonic single-cell human zygote). That is, upon fertilization, parts of human beings have actually been transformed into something very different from what they were before; they have been changed into a single, whole human being. During the process of fertilization, the sperm and the oocyte cease to exist as such, and a new human being is produced.

To understand this, it should be remembered that each kind of living organism has a specific number and quality of chromosomes that are characteristic for each member of a species. (The number can vary only slightly if the organism is to survive.) For example, the characteristic number of chromosomes for a member of the human species is 46 (plus or minus, e.g., in human beings with Down's or Turner's syndromes). Every somatic (or, body) cell in a human being has this characteristic number of chromosomes. Even the early germ cells contain 46 chromosomes; it is only their most mature forms—the sex gametes, or sperms and oocytes—which will later contain only 23 chromsomes.[1] Sperms and oocytes are derived from primitive germ cells in the developing fetus by means of the process known as "gametogenesis." Because each germ cell normally has 46 chromosomes, the process of "fertilization" can not take place until the total number of chromosomes in each germ are cut in half. This is necessary so that after their fusion at fertilization the characteristic number of chromosomes in a single individual member of the human

species (46) can be maintained—otherwise we would end up with a monster of some sort.

To accurately see why a sperm or an oocyte are considered as only possessing human life, and not as living human beings themselves, one needs to look at the basic scientific facts involved in the processes of **gametogenesis** and of **fertilization**. It may help to keep in mind that the products of gametogenesis and fertilization are very different. The products of gametogenesis are mature sex gametes with only 23 instead of 46 chromosomes. The product of fertilization is a living human being with 46 chromosomes. Gametogenesis refers to the maturation of germ cells resulting in gametes. Fertilization refers to the initiation of a new human being.

1) Gametogenesis

As the human embryologist Larsen[2] states it, **gametogenesis** is the process that converts primordial germ cells (primitive sex cells) into mature sex gametes—in the male (spermatozoa, or sperms), and in the female (definitive oocytes). The timing of gametogenesis is different in males and in females. The later stages of spermatogenesis in males occur at puberty, and continue throughout adult life. The process involves the production of spermatogonia from the primitive germ cells, which in turn become primary spermatocytes, and finally spermatids—or mature spermatozoa (sperms). These mature sperms will have only half of the number of their original chromosomes—i.e., the number of chromosomes has been cut from 46 to 23, and therefore they are ready to take part in fertilization.[3]

Oogenesis begins in the female during fetal life. The total number of primary oocytes—about 7 million—is produced in the female fetus' ovaries by 5 months of gestation in the mother's uterus. By birth, only about 700,000 - 2 million remain. By puberty, only about 400,000 remain. The process includes several stages of maturation—the production of oogonia from primitive germ cells, which in turn become primary oocytes, which become definitive oocytes only

at puberty. This definitive oocyte is what is released each month during the female's menstrual period, but it still has 46 chromosomes. In fact, it does not reduce its number of chromosomes until and unless it is fertilized by the sperm, during which process the definitive oocyte becomes a secondary oocyte with only 23 chromosomes.[4]

This halving of the number of chromosomes in the oocytes takes place by the process known as meiosis. Many people confuse meiosis with a different process known as mitosis, but there is an important difference. **Mitosis** refers to the normal division of a somatic, or germ cell in order to increase the number of those cells during growth and development. The resulting cells contain the same number of chromosomes as the previous cells—in human beings, 46. **Meiosis** refers to the halving of the number of chromosomes that are normally present in a germ cell—the precursors of a sperm or a definitive oocyte—in order for fertilization to take place. The resulting cells have only half of the number of chromosomes as the previous cells—in human beings, 23.

One of the best and most technically accurate explanations for this critical process of gametogenesis is by Ronan O'Rahilly,[5] the human embryologist who developed the classic Carnegie stages of human embryological development. He also sits on the international board of *Nomina Embryologica* (which determines the correct terminology to be used in human embryology textbooks internationally):

> "**Gametogenesis** is the production of [gametes], i.e., spermatozoa and oocytes. These cells are produced in the gonads, i.e., the testes and ovaries respectively. ... During the differentiation of gametes, diploid cells (those with a double set of chromosomes, as found in somatic cells [46 chromosomes]) are termed primary, and haploid cells (those with a single set of chromosomes [23 chromosomes]) are called secondary. The reduction of chromosomal number ... from 46 (the diploid number or 2n) to 23 (the haploid number or n) is accomplished by a cellular division termed meiosis. ... **Spermatogenesis**, the production of spermatozoa, continues from immediately after puberty until old age. It takes place in the testis, which is also an endocrine gland, the in-

terstitial cells of which secrete testosterone. Previous to puberty, spermatogonia in the simiferous tubules of the testis remain relatively inactive. After puberty, under stimulation from the interstitial cells, spermatogonia proliferate ... and some become primary spermatocytes. When these undergo their first maturation division (meiosis 1), they become secondary spermatocytes. The second maturation division (meiosis 2) results in spermatids, which become converted into spermatozoa."[6]

"**Oogenesis** is the production and maturation of oocytes, i.e., the female gametes derived from oogonia. Oogonia (derived from primordial germ cells) multiply by mitosis and become primary oocytes. The number of oogonia increases to nearly seven million by the middle of prenatal life, after which it diminishes to about two million at birth. From these, several thousand oocytes are derived, several hundred of which mature and are liberated (ovulated) during a reproductive period of some thirty years. Prophase of meiosis 1 begins during fetal life but ceases at the diplotene state, which persists during childhood. ... After puberty, meiosis 1 is resumed and a secondary oocyte ... is formed, together with polar body 1, which can be regarded as an oocyte having a reduced share of cytoplasm. The secondary oocyte is a female gamete in which the first meiotic division is completed and the second has begun. From oogonium to secondary oocyte takes from about 12 to 50 years to be completed. *Meiosis 2 is terminated after rupture of the follicle (ovulation) but only if a sperm atozoon penetrates.*... The term 'ovum' implies that polar body 2 has been given off, which event is usually delayed *until the oocyte has been penetrated by a sperm atozoon (i.e., has been fertilized).* Hence a human ovum does not [really] exist. Moreover the term has been used for such disparate structures as an oocyte and a three-week embryo, and therefore should be discarded, as *a fortiori* should 'egg'."[7] (Emphasis added.)

Thus, for fertilization to be accomplished, a mature sperm and a mature human oocyte are needed. Before fertilization,[8] each has only 23 chromosomes. They each possess "human life," since they are parts of a *living* human being; but they are not each whole living human beings themselves. They each have only 23 chromosomes, not 46 chromosomes—the number of chromosomes necessary and characteristic for a single individual member of the human species. Furthermore, a

sperm can produce only "sperm" proteins and enzymes; an oocyte can produce only "oocyte" proteins and enzymes; neither alone is or can produce a human being with 46 chromosomes.

Also, note O'Rahilly's statement that the use of terms such as "ovum" and "egg"—which would include the term "fertilized egg"—is scientifically incorrect, has no objective correlate in reality, and is therefore very misleading—especially in these present discussions. Thus these terms themselves would qualify as "scientific" myths. The commonly used term, "fertilized egg," is especially very misleading, since there is really no longer an egg (or oocyte) once fertilization has begun. What is being called a "fertilized egg" is not an egg of any sort; it is a human being.

2) Fertilization

Now that we have looked at the formation of the mature *haploid* sex gametes, the next important process to consider is fertilization. O'Rahilly defines **fertilization** as:

> "... the procession of events that begins when a spermatozoon *makes contact* with a secondary oocyte or its investments, and ends with the intermingling of maternal and paternal chromosomes at metaphase of the first mitotic division of the *zygote*. The zygote is characteristic of the last phase of fertilization and is identified by the first cleavage spindle. It is a unicellular *embryo*."[9] (Emphasis added.)

The fusion of the sperm (with 23 chromosomes) and the oocyte (with 23 chromosomes) at fertilization results in a live human being, a single-cell human zygote, with 46 chromosomes—the number of chromosomes characteristic of an individual member of the human species. Quoting Moore:

> "**Zygote:** This cell results from the union of an oocyte and a sperm. *A zygote is the beginning of a new human being (i.e., an embryo).* The expression *fertilized ovum* refers to a secondary oocyte that is impregnated by a sperm; when fertilization is complete, the oocyte becomes a zygote."[10] (Emphasis added.)

This new single-cell human being immediately produces specifically human proteins and enzymes[11] (not carrot or frog

enzymes and proteins), and genetically directs his/her own growth and development. (In fact, this genetic growth and development has been proven *not* to be directed by the mother.)[12] Finally, this new human being—the single-cell human zygote—is biologically an *individual*, a living organism—an individual member of the human species. Quoting Larsen:

> "... [W]e begin our description of the developing human with the formation and differentiation of the male and female sex cells or gametes, which will unite at fertilization to initiate the embryonic development of *a new individual.*"[13] (Emphasis added.)

In sum, *a human sperm and a human oocyte are products of gametogenesis each has only 23 chromosomes.* They each have only half of the required number of chromosomes for a human being. They cannot singly develop further into human beings. They produce only "gamete" proteins and enzymes. They do not direct their own growth and development. And they are not individuals, i.e., members of the human species. They are only parts—each one a part *of* a human being. On the other hand, *a human being is the immediate product of fertilization.* As such he/she is a single-cell embryonic zygote, an organism *with 46 chromosomes*, the number required of a member of the human species. This human being immediately produces specifically human proteins and enzymes, directs his/her own further growth and development *as human*, and is a new, genetically unique, newly existing, live human *individual.*

After fertilization the single-cell human embryo doesn't become another *kind* of thing. It simply divides and grows bigger and bigger, developing through several stages as an embryo over an 8-week period. Several of these developmental stages of the growing embryo are given special names, e.g., a morula (about 4 days), a blastocyst (5-7 days), a bilaminar (two layer) embryo (during the second week), and a trilaminar (3-layer) embryo (during the third week).[14]

B. Scientific myths and scientific facts

Given these basic facts of human embryology, it is easier to recognize the many scientifically inaccurate claims that have been advanced in

the discussions about abortion, human embryo research, cloning, stem cell research, the formation of chimeras, and the use of abortifacients—and why these discussions obfuscate the objective scientific facts. The following is just a sampling of these current "scientific" myths.

Myth 1: "Prolifers claim that the abortion of a human embryo or a human fetus is wrong because it destroys human life. But human sperms and human ova are human life, too. So prolifers would also have to agree that the destruction of human sperms and human ova are no different from abortions—and that is ridiculous!"

Fact 1: As pointed out above in the background section, there is a radical difference, scientifically, between parts of a human being that only possess "human life" and a human embryo or human fetus that is an actual "human being." Abortion is the destruction of a human being. Destroying a human sperm or a human oocyte would not constitute abortion, since neither are human beings. The issue is not when does human *life* begin, but rather when does the life of every human *being* begin. A human kidney or liver, a human skin cell, a sperm or an oocyte all possess human *life*, but they are not human *beings*—they are only parts of a human being. If a single sperm or a single oocyte were implanted into a woman's uterus, they would not grow; they would simply disintegrate.

Myth 2: "The product of fertilization is simply a 'blob,' a 'bunch of cells', a 'piece of the mother's tissues'."

Fact 2: As demonstrated above, the human embryonic organism formed at fertilization is a whole human being, and therefore it is not just a "blob" or a "bunch of cells." This new human individual also has a mixture of both the mother's and the father's chromosomes, and therefore it is not just a "piece of the *mother's* tissues". Quoting Carlson:

> "... [T]hrough the mingling of maternal and paternal chromosomes, the zygote is *a genetically unique product of chromosomal reassortment*, which is important for the viability of any species."[15] (Emphasis added.)

Myth 3: "The immediate product of fertilization is just a 'potential' or a 'possible' human being—not a real existing human being."

Fact 3: As demonstrated above, scientifically there is absolutely no question whatsoever that the immediate product of fertilization is a newly existing human being. A human zygote *is* a human being. It is *not* a "potential" or a "possible" human being. It's an actual human being—with the potential to grow bigger and develop its capacities.

Myth 4: "A single-cell human zygote, or embryo, or fetus are not human beings, because they do not look like human beings."

Fact 4: As all human embryologists know, a single-cell human zygote, or a more developed human embryo, or human fetus is a human being—and that that's the way they are supposed to look at those particular periods of development.

Myth 5: "The immediate product of fertilization is just an 'it'—it is neither a girl nor a boy."

Fact 5: The immediate product of fertilization is genetically already a girl or a boy—determined by the kind of sperm that fertilizes the oocyte. Quoting Carlson again:

> "...[T]he sex of the future embryo is determined by the chromosomal complement of the spermatozoon. (If the sperm contains 22 autosomes and 2 X chromosomes, the embryo will be a genetic female, and if it contains 22 autosomes and an X and a Y chromosome, the embryo will be a genetic male.)"[16]

Myth 6: "The embryo and the embryonic period begin at implantation." (Alternative myths claim 14 days, or 3 weeks.)

Fact 6: These are a few of the most common myths perpetuated sometimes even within quasi-scientific articles—especially within the bioethics literature. As demonstrated above, the human embryo, who is a human being, begins at fertilization—not at implantation (about 5-7 days), 14-days, or 3 weeks. Thus the embryonic period also begins at fertilization, and ends by the end of the eighth week, when the fetal period begins. Quoting O'Rahilly:

> "Prenatal life is conveniently divided into two phases: the embryonic and the fetal. The *embryonic period proper* during which the vast majority of the named structures of the body appear, occupies the *first 8 postovulatory weeks*. ... [T]he fetal period extends from 8 weeks to birth ..."[17] (Emphasis added.)

Myth 7: "The product of fertilization, up to 14-days, is not an embryo; it is just a 'pre-embryo'—and therefore it can be used in experimental research, aborted, or donated."

Fact 7: This "scientific" myth is perhaps the most common error that pervades the current literature. The term "pre-embryo" has quite a long and interesting history. (See Irving and Kischer, *The Human Development Hoax: Time To Tell The Truth!*, for extensive details and references.) But it roughly goes back to at least 1979 in the bioethics writings of Jesuit theologian Richard McCormick in his work with the Ethics Advisory Board to the United States Department of Health, Education and Welfare,[18] and those of frog developmental biologist Dr. Clifford Grobstein in a 1979 article in *Scientific American*,[19] and most notably in his classic book, *Science and the Unborn: Choosing Human Futures* (1988).[20] Both McCormick and Grobstein subsequently continued propagating this scientific myth as members of the Ethics Committee of the American Fertility Society, and in numerous influential bioethics articles, leading to its common use in bioethics, theological, and public policy literature to this day.

The term "pre-embryo" was also used as the rationale for permitting human embryo research in the British Warnock Committee Report (1984),[21] and then picked up by literally hundreds of writers internationally, including, e.g., Australian writers Michael Lockwood, Michael Tooley, Alan Trounson—and especially by Peter Singer (a philosopher), Pascal Kasimba (a lawyer), Helga Kuhse (an ethicist), Stephen Buckle (a philosopher) and Karen Dawson (a geneticist, not a human embryologist). Note that none of these is even a scientist, with the exception of Karen Dawson, who is just a geneticist.

Oddly, the influential book by Singer, Kuhse, Buckle, and Dawson, *Embryo Experimentation*,[22] (which uses the term "pre-embryo," and which contains no scientific references for its "human embryology" chart or its list of "scientific" terms), along with the work of theologian McCormick and frog developmental biologist Grobstein, was used in the United States as the *scientific* basis for the 1994 National Institutes of Heath (NIH) Human Embryo Research Report.[23] That Report concluded that the "preimplantation embryo" (they, too, originally used the term "pre-embryo") had only a "reduced moral status." (Both the Warnock Report and the NIH Report admitted that the 14-day limit for human embryo research was arbitrary, and could and must be changed if necessary.) It is particularly in the writings of these and other bioethicists that so much incorrect science is claimed in order to "scientifically" ground the "pre-embryo" myth and therefore "scientifically" justify many of the issues noted at the beginning of this article. This would include abortion, as well as the use of donated or "made-for-research" early human embryos in destructive experimental human embryo research (such as infertility research, cloning, stem cell research, the formation of chimeras, etc.).

To begin with, it has been demonstrated above that the immediate product of fertilization is a human being with 46 chromosomes, a human embryo, an individual member of the human species, and that this is the beginning of the embryonic period. However, McCormick and Grobstein[24] claim that even though the product of fertilization is genetically human, it is not a "developmental individual" yet—and in turn, this "scientific fact" grounds their moral claim about this "pre-embryo." Quoting McCormick:

> "I contend in this paper that *the moral status*—and specifically the controversial issue of personhood—*is related to the attainment of developmental individuality* (being the source of one individual) ... It should be noted that at the zygote stage the genetic individual is not yet developmentally single—a source of only one individual. As we will see, that does not occur until a single body axis has begun to form near the end

of the second week post fertilization when implantation is underway."[25] (Emphasis added.)

Sounds very scientific. However, McCormick's embryology is already self-contradictory. Implantation takes place at 5-7 days. The "single body axis" to which he refers is the formation of the primitive streak, which takes place at 14 days. McCormick often confuses these different periods in his writings. But McCormick continues:

"This multicellular entity, called a blastocyst, has an outer cellular wall, a central fluid-filled cavity and a small gathering of cells at one end known as the inner cell mass. Developmental studies show that the cells of the outer wall become the trophoblast (feeding layer) and are precursors to the later placenta. Ultimately, *all* these cells are discarded at birth."[26] (Emphasis added.)

The clear implication is that there is absolutely no relationship or interaction between these two cell layers, and so the "entity" is not a "developmental individual" yet. However, quoting Larsen:

"These centrally placed blastomeres are now called the inner cell mass, while the blastomeres at the periphery constitute the outer cell mass. *Some exchange occurs between these groups.* ... The cells of this germ disc (the inner cell layer) develop into the embryo proper and also contribute to some of the extraembryonic membranes."[27] (Emphasis added.)

Similarly, it is not factually correct to state that *all* of the cells from the outer trophoblast layer are discarded after birth. Quoting Moore:

"The chorion, the amnion, the yolk sac, and the allantois constitute the fetal membranes. They develop from the zygote but do not participate in the formation of the embryo or fetus—*except for parts of the yolk sac and allantois. Part of the yolk sac is incorporated into the embryo as the primordium of the gut. The allantois forms a fibrous cord that is known as the urachus in the fetus and the median umbilical ligament in the adult. It extends from the apex of the urinary bladder to the umbilicus.*"[28] (Emphasis added.)

Since scientists, in trying to "reach" young students in a more familiar language, sometimes use popularized (but scientifically

inaccurate and misleading) terms themselves, the ever-vigilant O'Rahilly expresses concern in his classic text about the use of the term "fetal membranes":

> "The developmental adnexa, commonly *but inaccurately* referred to as the 'fetal membranes,' include the trophoblast, amnion, chorion, umbilical vesicle (yolk sac), allantoic diverticulum, placenta and umbilical cord. *They are genetically a part of the* individual *and are composed of the same germ layers.*"[29] (Emphasis added.)

Consequently, it is also scientifically incorrect to claim that *only* the inner cell layer constitutes the "embryo proper." *The entire blastocyst including both the inner and the outer cell layers is the human embryo, the human being, the human individual.*

Finally, McCormick claims that this "pre-embryo" has not yet decided how many individuals it will become, since the cells are totipotent and twinning can still take place. Therefore, they argue, there is no "individual" present until 14-days and the formation of the primitive streak, after which twinning cannot take place.[30]

However, *twinning is possible after 14 days*, e.g., with fetus-in-fetu and Siamese twins. Quoting from O'Rahilly again:

> "Partial duplication at an early stage and attempted duplication *from 2 weeks onward* (when bilateral symmetry has become manifest) would result in conjoined twins (e.g., 'Siamese twins')."[31] (Emphasis added.)

And even Karen Dawson acknowledges this as scientific fact in her article in *Embryo Experimentation*:

> "*After the time of primitive streak formation*, other events are possible which indicate that the notion of 'irreversible individuality' may need some review if it is to be considered as an important criterion in human life coming to be the individual human being it is ever thereafter to be. There are two conditions which raise questions about the adequacy of this notion: conjoined twins, sometimes known as Siamese twins, and fetus-in-fetu. ... Conjoined twins arise from the twinning process *occurring after the primitive streak has begun to form, that is, beyond 14 days after fertilization*, or, in terms of the argument from segmentation, beyond the time at which irreversible individuality is said to exist. ... This

> situation weakens the possibility of seeing individuality as something irreversibly resolved by about 14 days after fertilization. This in turn raises questions about the adequacy of using the landmark of segmentation in development as the determinant of moral status."[32] (Emphasis added.)

It is unfortunate that the NIH Human Embryo Research Panel[33] did not read this particular portion of the Singer *et al.* book before making their recommendations about the moral status of the early human embryo.

The scientific fact is that there is no such thing as a "pre-embryo" in the real world. The term is a complete myth. It was fabricated out of thin air in order to justify a number of things that ordinarily would not be justifiable. Quoting O'Rahilly, who sits on the international board of *Nomina Embryologica*, again:

> "The *ill-defined and inaccurate term pre-embryo,* which includes the embryonic disk, is said either to end with the appearance of the primitive streak or to include neurulation. *The term is not used in this book.*[34] (Emphasis added.)

Unfortunately, the convenient but mythological term "pre-embryo" will be used to "scientifically" justify several of the other "scientific" myths to follow, which in turn will be used to justify public policy on abortion and human embryo research world-wide.

Myth 8: "Pregnancy begins with the implantation of the blastocyst (i.e., about 5-7 days)."

Fact 8: This definition of "pregnancy" was initiated to accommodate the introduction of the process of *in vitro* fertilization, where fertilization takes place artificially outside the mother in a petri dish, and then the embryo is artificially introduced into the woman's uterus so that implantation of the embryo can take place. Obviously, if the embryo is not within the woman's body, she is not "pregnant" in the literal, traditional sense of the term. However, this *artificial* situation cannot validly be substituted back to redefine "*normal* pregnancy," in which fertilization *does* take place within the

woman's body in her fallopian tube, and subsequently the embryo itself moves along the tube to implant itself into her uterus. In normal situations, pregnancy begins at fertilization, not at implantation. Quoting Carlson:

> "*Human pregnancy begins with the fusion of an egg and a sperm*, but a great deal of preparation precedes this event. First both male and female sex cells must pass through a long series of changes (gametogenesis) that converts them genetically and phenotypically into mature gametes, which are capable of participating in the process of fertilization. Next, the gametes must be released from the gonads and make their way to the upper part of the uterine tube, where fertilization *normally* takes place. Finally, *the fertilized egg, now properly called an embryo,* must make its way into the uterus, where it sinks into the uterine lining (implantation) to be nourished by the mother."[35] (Emphasis added.)

Myth 9: "The 'morning-after pill,' RU486, and the IUD are not abortifacient; they are only methods of contraception."

Fact 9: The "morning-after pill," RU486, and the IUD *can* be abortifacient, *if fertilization has taken place.* Then they would act to prevent the implantation of an already existing human embryo—the blastocyst—which is an existing human being. If the developing human blastocyst is prevented from implanting into the uterus, then obviously the embryo dies. In effect, these chemical and mechanical methods of contraception have become methods of abortion as well. Quoting Moore:

> "The administration of relatively large doses of estrogens ('morning-after pill') for several days, beginning shortly after unprotected sexual intercourse, *usually does not prevent fertilization but often prevents implantation of the blastocyst.* Diethylstilbestrol, given daily in high dosage for 5-6 days, may also accelerate passage of the dividing zygote along the uterine tube ... Normally, the endometrium progresses to the secretory phase of the menstrual cycle as the zygote forms, undergoes cleavage, and enters the uterus. The large amount of estrogen disturbs the normal balance between estrogen and progesterone that is necessary for preparation of the endometrium for implantation of the blastocyst. Postconception administration of hormones to prevent

> implantation of the blastocyst is sometimes used in cases of sexual assault or leakage of a condom, but this treatment is contraindicated for routine contraceptive use. *The abortion pill RU486 also destroys the conceptus by interrupting implantation* because of interference with the hormonal environment of the implanting embryo. ... An intrauterine device (IUD) inserted into the uterus through the vagina and cervix usually interferes with implantation by causing a local inflammatory reaction. Some IUDs contain progesterone that is slowly released and interferes with the development of the endometrium so that implantation does not usually occur."[36] (Emphasis added.)

And since the *whole* human blastocyst is the embryonic human being—not *just* the inner cell layer—the use of chemical abortifacients that act "only" on the outer trophoblast layer of the blastocyst, e.g., methotrexate,[37] would be abortifacient as well.

Myth 10: "Human embryo research, human cloning, stem cell research, and the formation of chimeras are acceptable kinds of research because until implantation or 14 days there is only a 'pre-embryo', a 'potential' human embryo or human being present. A real human embryo and a human being (child) do not actually begin unless and until the 'pre-embryo' is implanted into the mother's uterus."

Fact 10: These claims are currently being made by bioethicists, research scientists, pharmaceutical companies, and other biotech research companies—even by some members of Congress. However, they too are "scientific" myths.

Scientifically it is perfectly clear that *there is no such thing as a pre-embryo,* as demonstrated in Fact 7. As demonstrated in the background material, the immediate product of fertilization is *a human being*, a human embryo, a human child—the zygote. This zygote is a newly existing, genetically unique, genetically male or female, individual human being—*it is not a potential or a possible human being.* And this developing human being is a human being, a human embryo, a human child *whether or not it is implanted artificially into the womb of the mother.*

Fertilization and cloning are different processes, but the immediate products of these processes are the same. The immediate product of human cloning would also be a human being—just as in human fertilization. It is not a "pre-embryo" or a "potential" human embryo or human being. Stem cell research obtains its "stem cells" by essentially exploding or otherwise destroying and killing a newly existing human blastocyst who is, scientifically, an existing human being. The formation of chimeras, i.e., the fertilization of a gamete of one species (e.g., a human oocyte) with the gamete of another species (e.g., a monkey sperm) also results in an embryo that is "half-human." All of these types of research have been banned by most countries in the world. *And all of these types of research are essentially human embryo research*—for which the use of federal funds has been banned.

Myth 11: "Certain early stages of the developing human embryo and fetus, e.g., during the formation of ancestral fish gills or tails, demonstrates that it is not yet a human being, but is only in the process of becoming one. It is simply 'recapitulating' the historical evolution of all of the species."

Fact 11: This "scientific" myth is yet another version of the "potential," "possible," "pre-embryo" myths. It is an attempt to deny the early human embryo its real identity as a human being and its real existence. But quoting once again from O'Rahilly:

> "The theory that successive stages of individual development (ontogeny) correspond with ('recapitulate') successive adult ancestors in the line of evolutionary descent (phylogeny) became popular in the 19th century as the so-called biogenetic law. This theory of recapitulation, however, has had a 'regrettable influence in the progress of embryology' (citing de Beer). ... Furthermore, during its development an animal departs more and more from the form of other animals. Indeed, the early stages in the development of an animal are not like the adult stages of other forms, but resemble only the early stages of those animals."[38]

Hence, the developing human embryo or fetus is not a "fish" or a "frog," but is categorically a human being—as has been already demonstrated.

III. When does a human *person* begin?

The question as to when a human *person* begins is a *philosophical* question—not a scientific question. I will not go into great detail here,[39] but "personhood" begins when the human being begins—at fertilization. But since many of the current popular "personhood" claims in bioethics are also based on mythological science, it would be useful to just look very briefly at these philosophical (or sometimes, theological) arguments simply for scientific accuracy as well.

Philosophically, virtually *any* claim for so-called "*delayed* personhood"—that is, "personhood" does not start until some point *after* fertilization—involves the theoretical disaster of accepting that the idea or concept of a mind/body split has any correlate or reflects the real world. Historically this problem was simply the consequence of wrong-headed thinking about reality, and was/is totally indefensible. It was abandoned with great embarrassment after Plato's time (even by Plato himself in his *Parmenides*!), but unfortunately resurfaces from time to time, e.g., as with Descartes in his *Meditations*, and now again with contemporary bioethics.[40] And as in the question of when a human being begins, if the *science* used to ground these philosophical "personhood" arguments is incorrect, the conclusions of these arguments (which are based on that incorrect science) are also incorrect and invalid.

Myth 12: "Maybe a human *being* begins at fertilization, but a human *person* does not begin until after 14-days, when twinning cannot take place."

Fact 12: The particular argument in Myth 12 is also made by McCormick and Grobstein (and their numerous followers). It is based on their biological claim that the "pre-embryo" is not a developmental individual, and therefore not a person, until after 14 days when twinning can no longer take place. However, it has already

been scientifically demonstrated here that there is no such thing as a "pre-embryo," and that in fact the embryo begins as a "developmental individual" at fertilization. Furthermore, twinning can take place after 14 days. Thus simply on the level of science, the philosophical claim of "personhood" advanced by these bioethicists is invalid and indefensible.

Myth 13: "A human *person* begins with 'brain birth,' the formation of the primitive nerve net, or the formation of the cortex—all physiological structures necessary to support thinking and feeling."

Fact 13: Such claims are all pure mental speculation, the product of imposing philosophical (or theological) concepts on the scientific data, and have no scientific evidence to back them up. As the well-known neurological researcher D. Gareth Jones has succinctly put it, the parallelism between "brain death" and "brain birth" is *scientifically invalid.* "Brain death" is the gradual or rapid cessation of the functions of a brain. "Brain birth" is the very gradual acquisition of the functions of a developing neural system. This developing neural system is not a brain. He questions, in fact, the entire assumption and asks what neurological reasons there might be for concluding that an incapacity for consciousness becomes a capacity for consciousness once this point is passed. Jones continues that the alleged symmetry is not as strong as is sometimes assumed, and *that it has yet to be provided with a firm biological base.*[41]

Myth 14: "A 'person' is defined in terms of the active exercising of 'rational attributes' (e.g., thinking, willing, choosing, self-consciousness, relating to the world around one, etc.), and/or the active exercising of 'sentience' (e.g., the feeling of pain and pleasure)."

Fact 14: Again, these are philosophical terms or concepts, which have been illegitimately imposed on the scientific data. The scientific fact is that the brain, which is supposed to be the physiological support for *both* "rational attributes" *and* "sentience," is not actually completely developed until young adulthood. Quoting Moore:

> "Although it is customary to divide human development into prenatal (before birth) and postnatal (after birth) periods, birth is merely a dramatic event during development resulting in a change in environment. *Development does not stop at birth.* Important changes, in addition to growth, occur after birth (e.g., development of teeth and female breasts). The brain triples in weight between birth and 16 years; *most developmental changes are completed by the age of 25.*"[42] (Emphasis added.)

One should also consider simply the logical—and very real—consequences if a "person" is defined only in terms of the actual exercising of "rational attributes" or of "sentience." What would this mean for the following list of adult human beings with diminished "rational attributes": e.g., the mentally ill, the mentally retarded, the depressed elderly, Alzheimer's and Parkinson's patients, drug addicts, alcoholics—and for those with diminished "sentience," e.g., the comatose, patients in a "vegetative state," paraplegics, and other paralyzed and disabled patients, diabetics or other patients with nerve or brain damage, etc.? Would they then be considered as only human beings but not also as human persons? Would that mean that they would not have the same ethical and legal rights and protections as those adult human beings who are considered as persons? Is there really such a "split" between a human being and a human person?

In fact, this is the position of bioethics writers such as the Australian animal rights philosopher Peter Singer,[43] the recently appointed Director of the Center for Human Values at Princeton University. Singer argues that the higher primates, e.g., dogs, pigs, apes, monkeys, *are* persons—but that some human beings, e.g., even normal human infants, and disabled human adults, are *not* persons. Fellow bioethicist Norman Fost actually considers "cognitively impaired" adult human beings as "brain dead." Philosopher/bioethicist R.G. Frey has also published that many of the adult human beings on the above list are not "persons," and suggests that they be substituted for the higher primates who are "persons" in purely destructive experimental research.[44] The list goes on.

IV. Conclusions

Ideas do have concrete consequences—not only in one's personal life, but also in the formulation of public policies. And once a definition is accepted in one public policy, the logical extensions of it can then be applied, invalidly, in many other policies, even if they are not dealing with the same exact issue—as happens frequently in bioethics. Thus, the definitions of "human being" and of "person" that have been concretized in the abortion debates have been transferred to several other areas, e.g., human embryo research, cloning, stem cell research, the formation of chimeras, the use of abortifacients—even to the issues of brain death, brain birth, organ transplantation, the removal of food and hydration, and research with the mentally ill or the disabled. But neither private choices nor public policies should ever incorporate unsound or inaccurate science. What I have tried to indicate is that in these current discussions, individual choices and public policies have been based on "scientific" myth, rather than on objective scientific facts.

Notes

1. B. Lewin, *Genes III* (New York: John Wiley and Sons, 1983), pp. 9-13; A. Emery, *Elements of Medical Genetics* (New York: Churchill Livingstone, 1983), pp. 19, 93.

2. William J. Larsen, *Human Embryology* (New York: Churchill Livingstone, 1997), pp. 4, 8, 11.

3. *Ibid.*

4. *Ibid.*

5. Ronan O'Rahilly and Fabiola Müller, *Human Embryology & Teratology* (New York: Wiley-Liss, 1994). See also, Bruce M. Carlson, *Human Embryology and Developmental Biology* (St. Louis, MO: Mosby, 1994), and Keith L. Moore and T.V.N. Persaud, *The Developing Human* (Philadelphia: W.B. Saunders Company, 1998).

6. O'Rahilly and Müller 1994, pp. 13-14.

7. *Ibid.*, p. 16. See also, Larsen, *op. cit.*, pp. 3-11; Moore and Persaud, *op. cit.*, pp. 18-34; Carlson, *op. cit.*, pp. 3-21.

8. *Note:* The number of chromosomes in the definitive oocyte are not halved unless and until it is penetrated by a sperm, which really does not take place *before* fertilization but is in fact concurrent with and the beginning of the process of fertilization. However, for simplicity's sake, many writers (myself among them) will sometimes assume the reader clearly understands this timing, and simply say, "*before* fertilization the sperm and the oocyte each contain 23 chromosomes."

9. O'Rahilly and Müller, p. 19.

10. Moore and Persaud, p. 2.

11. E.g., as determined in extensive numbers of transgenic mice experiments as in Kollias *et al.*, "The human beta-globulin gene contains a downstream developmental specific enhancer," *Nucleic Acids Research* 15(14) (July, 1987), 5739-47; also similar work by, e.g., R.K. Humphries, A. Schnieke.

12. Holtzer *et al.*, "Induction-dependent and lineage-dependent models for cell-diversification are mutually exclusive," *Progress in Clinical Biological Research* 175:3-11 (1985); also similar work by, e.g., F. Mavilio, C. Hart.

13. Larsen, p. 1; also O'Rahilly and Müller, p. 20.

14. Larsen, p. 19, 33, 49.

15. Carlson, p. 31.

16. Carlson, p. 31.

17. O'Rahilly and Müller, p. 55; Carlson, p. 407.

18. Ethics Advisory Board, 1979, *Report and Conclusions: HEW Support of Research Involving Human In Vitro Fertilization and Embryo Transfer*, Washington, D.C.: United States Department of Health, Education and Welfare, p. 101.

19. Clifford Grobstein, "External human fertilization," *Scientific American* 240:57-67.

20. Clifford Grobstein, *Science and the Unborn: Choosing Human Futures* (New York: Basic Books, Inc., 1988).

21. Dame Mary Warnock, *Report of the Committee of Inquiry into Human Fertilization and Embryology* (London: Her Majesty's Stationary Office, 1984), pp. 27, 63. See also the writings of, e.g., H. Tristram Engelhardt, John Robertson (in legal writings), R.M. Hare, Bedate and Cefalo, William Wallace.

22. Peter Singer, Helga Kuhse, Stephen Buckle, Karen Dawson, and Pascal Kasimba, *Embryo Experimentation* (Cambridge: Cambridge University Press, 1990).

23. *National Institutes of Health: Report of the Human Embryo Research Panel*, September 27, 1994 (National Institutes of Health, Division of Science Policy Analysis and Development, Bethesda, MD).

24. Clifford Grobstein, "The early development of human embryos," *Journal of Medicine and Philosophy* 1985:10:213-236; and Richard McCormick, "Who or what is the preembryo?" *Kennedy Institute of Ethics Journal* 1991:1:1-15.

25. Richard McCormick, *ibid.*, p. 3.

26. McCormick, *ibid.*, p. 3.

27. Larsen, p. 19, 33.

28. Moore and Persaud, p. 131.

29. O'Rahilly and Müller, p. 51.

30. McCormick, *op. cit.*, p. 4.

31. O'Rahilly and Müller, p. 32.

32. Karen Dawson, "Segmentation and moral status," in Peter Singer *et al.*, *Embryo Experimentation* (Cambridge: Cambridge University Press, 1990), p. 58. See also Moore and Persaud, p. 133.

33. For extensive comments on the make-up of the NIH Human Embryo Research Panel and on its Report, see several of my articles

in Ward C. Kischer and Dianne N. Irving, *The Human Development Hoax: Time to Tell The Truth!*, (1st ed., Clinton Township, MI: Gold Leaf Press, 1995); (2nd ed., published by authors; distributed by American Life League, 1997).

34. O'Rahilly and Müller, p. 55.

35. Carlson, p. 3.

36. Moore and Persaud, p. 58.

37. But see Albert Moraczewski, "Managing tubal pregnancies: Part I" (June 1996) and "Part II" (August 1996), in *Ethics and Medics* (Braintree, MA: Pope John Center).

38. O'Rahilly and Müller, p. 8-9.

39. The use of massive historically incorrect and theoretically indefensible philosophy in the "delayed personhood" arguments has been addressed in my doctoral dissertation, *A Philosophical and Scientific Analysis of the Nature of the Early Human Embryo* (Washington, D.C.: Georgetown University, Department of Philosophy, 1991); see also several of my previously published articles in my book, co-authored by C. Ward Kischer, *The Human Development Hoax: Time To Tell The Truth, supra.*, which gives extensive references pro and con these bioethics arguments.

40. For an excellent and easy to read analysis of the problem of a mind/body split as one of the fundamental theoretical problems in contemporary bioethics theory, see Gilbert C. Meilaender, *Body, Soul, and Bioethics* (Notre Dame, IN: University of Notre Dame Press, 1995); see also many of the excellent articles about this problem in bioethics theory in Raanan Gillon (ed.), *Principles of Health Care Ethics* (New York: John Wiley & Sons, 1994); also Edwin R. DuBose, Ronald P. Hamel and Laurence J. O'Connell (eds.), *A Matter of Principles? Ferment in U.S. Bioethics* (Valley Forge, PA: Trinity Press International, 1994)—especially the "Preface" by Albert Jonsen. Even Daniel Callahan has admitted that the bioethics principles don't work, in "Bioethics: Private choice and common good," in *The Hastings Center Report* (May/June 1994), pp. 28-31.

41. D. Gareth Jones, "Brain birth and personal identity," *Journal of Medical Ethics* 15:4, 1989, p. 178.

42. Moore and Persaud, p. 2; see also Jones, p. 177.

43. Peter Singer, "Taking life: Abortion," in *Practical Ethics* (London: Cambridge University Press, 1981), p. 118; Helga Kuhse and Peter Singer, "For sometimes letting—and helping—die," *Law, Medicine and Health Care*, 1986, 3:4:149-153; Kuhse and Singer, *Should the Baby Live? The Problem of Handicapped Infants* (Oxford: Oxford University Press, 1985), p. 138; Singer and Kuhse, "The ethics of embryo research," *Law, Medicine and Health Care*, 1987, 14:13-14; Michael Tooley, "Abortion and infanticide," in Marshall Cohen (ed.) *et al., The Rights and Wrongs of Abortions*, (New Jersey: Princeton University Press, 1974), pp. 59, 64; H. Tristram Engelhardt, *The Foundations of Bioethics* (New York: Oxford University Press, 1986), p. 111.

44. R.G. Frey, "The ethics of the search for benefits: Animal experimentation in medicine," in Raanan Gillon (ed.), *Principles of Health Care Ethics* (New York: John Wiley & Sons, 1994), pp. 1067-1075.