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“New Age” Embryology Text Books: Implications for Fetal Research

by

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As outrageous as it is that so much incorrect science has been and still is being used in the scientific, medical and bioethics literature to argue that fetal “personhood” does not arrive until some magical biological marker event during human embryological development, now we can witness the “new wave” consequences of passively *allowing* such incorrect “new age” science to be published and eventually accepted by professionals and non-professionals alike. Once these scientifically erroneous claims, and the erroneous philosophical and theological concepts they engender, are successfully imbedded in these bodies of literature and in our collective consciousnesses, the next logical step is to imbed them in our text books, reference materials and federal regulations.

Such is the case with the latest fifth edition of a highly respected embryology text book by Keith Moore - *The Developing Human*.¹ This text is used in most medical schools and graduate biology departments here, and in many institutions abroad. Several definitions and redefinitions of scientific terms it uses are incorporated, it would seem, in order to support the “new age” political agenda of abortion and fetal research. Indeed, this embryology text book actually explicitly engages in abortion counseling — a quite inappropriate use of a basic scientific text book — and uses these incorrectly defined scientific terms to ground and justify its conclusions about the “scientific correctness” of abortion. What is often not realized is that these redefinitions would justify fetal research as well. Of particular concern is Moore’s sudden use of the scientifically erroneous term “**pre-embryo**” in his most recent fifth edition — a fact recently pointed out by Dr. C. Ward Kischer², a professor of *human* embryology for over 30 years, who along with others have rejected the scientific validity of this term.³

What is true in the fetal personhood arguments is true in medical and scientific educational text books. The term “pre-embryo” is based on incorrect science and should not be used. Unfortunately, as Dr. Kischer has also pointed out, the erroneous term “pre-embryo” has also been incorporated in the latest edition of

*Nomina Embryologica*⁴ — the international nomenclature reference text which certainly will influence medical and embryology text books world-wide to comply with the inclusion of this terminology — and presumably with abortion counseling and fetal research as well.

There are *no valid or sound scientific, philosophical or theological bases* for the use of a term like “pre-embryo”, for its use in arguments on fetal “personhood”, or for its inclusion as a legitimate stage of human development in *any* article, book or text — especially an embryological text book or official international reference for embryological nomenclature. Nor should this scientifically erroneous term be allowed to be used as a *scientific rationale* to justify the abortion of a pre-born child, or for his or her use in fetal research. Scientific and ethical reasons then would certainly preclude these texts from being used in any Catholic educational or health care institutions or facilities.

It is a given that any scientific text must be updated and changed to keep up with the rapid scientific advancements in basic knowledge. But there is a point past which updating ends, and politicizing begins. I leave it up to the readers to determine if that point has been passed with this text.

An examination and comparison of Moore's third and fifth editions will indicate considerable contradictions and confusion in terminology, yet a definite progression in the definition and use of several basic scientific terms, terms which will ground the eventual use of the erroneous term “pre-embryo” in his fifth edition. In turn, the use of the term “pre-embryo” in the fifth edition will ground and scientifically justify the abortion counseling which, I want to point out, is also blatantly incorporated in this text book. And if Moore's texts were to be referred to by public policy makers in their considerations for the use of human subjects in experimental research, the present OPRR regulations could be “corrected” to allow for unfettered research on preborn human beings up to the *ninth week* of embryological development. Furthermore, the conceptual precedents being established now in the arguments on fetal “personhood” in the abortion and fetal research issues are transferable to certain “classes” of *adult* human beings, rendering them “non-persons”, and therefore arguably prime candidates for their use in basic and medical research as well. First I will turn to a comparison of these two editions, and trace in particular the confusing etiology of the terms “pre-embryo”, “embryo”, and “pregnancy”.

Evolution of the Definition of the Scientifically Erroneous Term “Pre-Embryo”

The term “pre-embryo” has an interesting recent history, originally used in debates on the use of “early human embryos” in experimental medical research. The term was actually implied as far back as 1979 by the Ethics Advisory Board to the United States Department of Health, Education and Welfare: “. . . the [early] human embryo is entitled to profound respect, but this respect does not necessarily encompass the full legal and moral rights attributed to persons”.⁵ In the 1984 Warnock Committee Report in Great Britain, a similar sentiment was expressed:

"The human embryo . . . is not under the present law of the United Kingdom accorded the same status as a living child or adult, nor do we necessarily wish it to be accorded the same status. Nevertheless, we were agreed that the [early] embryo of the human species ought to have a special status."⁶ The debate was taken up in Australia and the term "pre-embryo" was rejected by the 1986 Harradine "Human Experimentation Bill".⁷ It was similarly rejected by several other international commissions, e.g., the 1986 and 1989 reports of the Parliamentary Assembly of the Council of Europe.⁸

In the United States, the Ethics Committee of the American Fertility Society claimed in its 1986 special report that early events in mammalian development concern, above all, the formation of extraembryonic — rather than embryonic — structures. "This means that the zygote, cleavage and early blastocyst stages should be regarded as preembryonic rather than embryonic."⁹ This theme, that there is a significant developmental structural (and therefore moral) difference between the "extraembryonic" and the "embryonic" membranes of the "early" human embryo, was echoed by several members of the Ethics Committee of the American Fertility Society. Howard Jones, a pioneer in infertility "therapy" and *in vitro* fertilization clinics, argued: "While the embryoblast segregates and is recognizable toward the end of [preimplantation], it consists of only a few cells, which are the rudiment of the subsequent embryo."¹⁰ Another member, John Robertson¹¹, uses the same rationale in the legal arena to argue for "brain-birth". He often quotes full pages from the work of another member of the Ethics Committee of the American Fertility Society, Clifford Grobstein,¹² who is also involved in *in vitro* fertilization studies, and whose specialty is *amphibian* embryology (not human embryology). Yet another member of the Ethics Committee of the American Fertility Society, Richard McCormick, S.J., in his own arguments about the "moral" status of the human "preembryo", quotes from Grobstein's "embryology", as well as from "an unpublished study of a research group of the Catholic Health Association entitled 'The Status and Use of the Human Preembryo'."¹³ According to Grobstein and McCormick,¹⁴ "pre-embryos" are merely "genetic individuals" and not "developmental individuals" yet, and therefore they are not "*persons*". Since they are not legitimate full-blown "*persons*" yet, they do *not* have the moral or legal rights and protections that actual human persons possess (and therefore one could argue that these "pre-embryos" could be aborted, experimented with, disposed of, etc.).

As noted, the new fifth edition of Keith Moore's *The Developing Human* incorporates the erroneous embryological term "pre-embryo" for the first time as a legitimate "stage" of human development by stating: "The **pre-embryonic** period of human development begins at fertilization..." (p.37). In Chapter Eight Moore states: "*In vitro* studies of cleaving human zygotes (**pre-embryo**) less than 5 days old have revealed a high incidence of abnormalities." And in the same chapter he states: "Inactivation of genes on one X chromosome in somatic cells of female **pre-embryos** occurs at about the time of implantation..." (p.144).

Perhaps it is worth noting the source on which Moore bases his nomenclature in his fifth edition: "The terminology in this book is based on the third edition of *Nomina Embryologica* which was published as part of the sixth edition of *Nomina*

Anatomica (Warwick, 1989)".¹⁵ Yet a number of writers have argued cogently and vigorously that the science, philosophy and theology used to ground the term "pre-embryo" is erroneous, and therefore the ethical and legal conclusions about the "personhood" of the early developing human being (based on that erroneous science) are also erroneous. Why would Moore or *Nomina Embryologica* suddenly use such a controversial term as "pre-embryo" now?

The term simply has no basis in fact, and has been flatly rejected by other eminent human embryologists who refuse to use the scientifically erroneous term in their own human embryology text books. As Kischer so succinctly noted, *human* embryologists do not use or acknowledge the term "pre-embryo". For example, O'Rahilly and Muller state quite emphatically in their human embryology text book: "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 in the *Nomina Embryologica*) to include neurulation. *The term is not used in this book*"¹⁶ (emphasis mine). Kischer also points out that the term is not indexed or used in the most recent edition of Stedman's Medical Dictionary,¹⁷ in any of the established human embryology texts - e.g., in Larsen's¹⁸ or in Patten's¹⁹ texts - nor in the scientific literature on human development. As he notes, there is *no such stage* in human development as the "pre-embryo", and he cautions that: "Human embryology is now in danger of being rewritten as a stratagem statement of current socio-legal, but also of late, even theological, issues. Unless the errors are corrected now, we will be in danger of entering a protracted period of *false concepts concerning our own development*"²⁰ (emphasis mine).

A. Ambiguity in Moore's texts

In their arguments, Grobstein and McCormick claim that the "pre-embryo" is not a "developmentally single individual" (and therefore not yet a "person") because, for example, in the 5-6 day old blastocyst, *all* of the cells of the outer trophoblast layer are discarded after birth. *Only* the cells from the inner embryoblast layer become the later fetus and adult human being.²¹

Strangely, in both the third and the fifth editions of Moore's texts, such scientific statements about the blastocyst are made by Moore in the early chapters of the texts. But in other later chapters of both texts, Moore bluntly contradicts those scientific statements, and thus in effect contradicts any supposed claims that could be made about "pre-embryos" and "personhood". These scientific contradictions are confusing. For example, in the early chapters of both texts he states:

Third Edition

During stage 3 of development (about four days), cavities appear inside the compact mass of cells forming the morula, and fluid soon passes into these cavities from the uterine cavity. As the fluid increases, it **separates** the cells into two parts: (1) an outer cell layer, the **trophoblast** . . . which **gives rise to part of the placenta**, and (2) a group of centrally located cells, known as the inner cell mass (or **embryoblast**), which **gives rise to the embryo**. (p. 33; also in summary, p. 37)

[In Figure depicting the cleavage of the zygote and the formation of the blastocyst] (p. 34)

NOT MENTIONED

NOT MENTIONED

Fifth Edition

Shortly after the morula enters the uterus (about four days after fertilization), spaces appear between the central blastomeres of the morula. Fluid soon passes through the zona pellucida into these spaces from the uterine cavity. As the fluid increases, it **separates** the blastomeres into two parts: (1) a thin outer cell layer (or "mass") called the **trophoblast** . . . which **gives rise to part of the placenta**, and (2) a group of centrally located blastomeres, known as the inner cell mass (or **embryoblast**), which **gives rise to the embryo**. (p. 35; also in summary, p. 38)

[In Figure depicting cleavage of the zygote and formation of the blastocyst]: The inner cell mass, or **embryoblast**, **gives rise to the tissues and organs of the embryo**. (p. 34)

[formulation of the morula] Compaction permits greater cell-to-cell interaction and is a prerequisite for **segregation** of the internal cells that **form the embryoblast** or inner cell mass of the blastocyst. (p. 33)

The strong implication here is that there is a clear separation between the inner and outer cell layers. The cells from the outer trophoblast layer are essentially non-embryonic, and in fact are all discarded after birth as placental membranes, etc. Only those cells from the inner layer, i.e., the *embryoblast*, actually really ever become or make up the cells, tissues and organs of the *later* embryo, fetus and adult human being. The philosophical (and theological) implication that Grobstein and McCormick want to draw is that because of this early strict separation and eventual separate and different "ontological" destinations and fates, there is as yet no "developmental" individual present (and therefore no "person"). The "pre-embryo", then, is to be considered as a "pre-person".

However, in Chapter 7 (in both editions), i.e. "The Fetal Membranes and Placenta", Moore *contradicts* his own earlier scientific statements about the relation between the inner and outer cell layers, and whether or not, in fact, *both* cell layers intermingle from the beginning, and *both* cell layers are represented later in the embryo, fetus and the adult human being:

Third Edition

During stage 5 of development (7-12 days), as the *blastocyst* is implanting, early differentiation of the **inner** cell mass occurs. A flattened layer of cells, the **hypoblast** (primitive endoderm), appears on the surface of the inner cell mass facing the blastocyst cavity at about seven days. . . Recent evidence indicates that the **hypoblast is probably displaced to extraembryonic regions**. (p. 33)

Fifth Edition

At about 7 days, a flattened layer of cells called the **hypoblast** (primitive *endoderm*) appears on the surface of the inner cell mass facing the blastocyst cavity . . . [NO DISCUSSION OF ITS DISPLACEMENT] (p. 36)

Cells, probably from the hypoblast, give rise to a layer of loosely arranged tissue, called the extraembryonic mesoderm, around the amnion and primary yolk sac. . . [footnotes 1,2] The origin of the exocoelomic membrane in the human embryo is thought to be derived from the hypoblast . . . From studies in the rhesus monkey, there is evidence for the formation of extraembryonic mesoderm from the hypoblast. (p. 42)

The chorion, the amnion, the yolk sac and the allantois constitute the embryonic or fetal membranes. These membranes develop from the zygote but do not form parts of the embryo, with the exception of portions of the yolk sac and allantois. The dorsal part of the yolk sac is incorporated into the embryo as the primordium of the primitive gut . . . The allantois is represented in the adult as a fibrous cord, the median umbilical ligament, which extends from the apex of the urinary bladder to the umbilicus. (p. 111)

The chorion, the amnion, the yolk sac and the allantois constitute the embryonic or fetal membranes. These membranes develop from the zygote but do not form parts of the embryo, with the exception of portions of the yolk sac and allantois. The dorsal part of the yolk sac is incorporated into the embryo as the primordium gut . . . The allantois is represented in the adult as a fibrous cord, the median umbilical ligament, which extends from the apex of the urinary bladder to the umbilicus. (p. 113)

These statements from the later chapters are a clear and direct contradiction of his own statements in the earlier chapters. Moore can't have it both ways. Scientifically and factually, either all of the cells of the trophoblast layer are discarded after birth, or they aren't. Again, some parts of his text imply a black and white separation of the two cell layers: other parts of his text indicate an intrinsic intermingling between the two layers. Scientifically and factually, either there is absolutely no intermingling of the cells of the two layers, or there is. Aside from the confusion these contradictions cause on the purely scientific level, different possible philosophical conclusions on "personhood" follow from these contradictory scientific claims. And different conclusions on ethical and legal rights and protections follow from these contradictory philosophical definitions of "personhood".

The stakes surrounding these "personhood" arguments are, after all, rather high for *preborn* human beings. If there is no such thing as an absolute separation; if there is always an intermingling of and communication between the two cell layers: if throughout all of human embryological development the two cell layers and the cells, tissues and organs which are produced from them intermingle; then individuality - both genetic *and* developmental - is present from fertilization on, and therefore so is "personhood". On the other hand, if Moore, Grobstein and McCormick are scientifically correct, if there is no continuum of development, and therefore no human "person" yet present in this 5-6 day old human blastocyst (even assuming that the argument is a valid one), what is wrong, then, with using them in destructive experimental basic and medical research? Couldn't one also scientifically and ethically rationalize any type of abortion, including the use of the "morning after" pill, or French RU486 abortion pill - since what is being aborted is really a "non-person", i.e., a "pre-embryo"?

But the stakes in these "personhood" arguments are just as high for adult human beings as well. Consider that many of the positions for abortion and fetal research argue that these early developing human beings are not persons because they do not exercise "rational attributes"²² (e.g., self-awareness, self-consciousness, awareness of the world around one, etc.) or have advanced levels of "sentience"²³ (the ability to feel pain and pleasure). Since empirically we know that the actual exercising of "rational attributes" and the actual capacity for full "sentience" are not present until *well after birth*²⁴, these same writers argue, therefore, that infanticide of normal healthy infants and young children is ethically permissible. Consider, now, that such "conceptual tools" (i.e. redefinitions) would also allow one to conclude logically that certain classes of adult human beings who also do not exercise "rational attributes" or "sentience" would also not be "persons", e.g.: patients with Alzheimer's and Parkinson's diseases, the mentally ill, the mentally retarded, the comatose, drug addicts, alcoholics, stroke victims and paraplegics, etc. If they are not "persons", then they will also not be entitled to ethical or legal protections. Couldn't one also logically argue then, that these human adults can be terminated or used in experimental research - if the "proportionate" need were to arise?

These "redefinitions" of "personhood" are nothing less than politically correct or "new age" criteria for "quality of life" decisions. They seem to be creeping up all over the place, in many different fields - crossing over from the issues about abortion and fetal research into issues concerning adult human beings. That is, the "conceptual precedents" which are being set in the issues of abortion and fetal research can be transferred to other areas involving adult human beings, e.g., the role that "personhood" plays in the debates about cortical brain-death, organ transplantation, the withholding and withdrawal of medical treatments, allocation of scarce resources, euthanasia, and any informed consent issues (e.g., living will, informed consent for medical treatment or to take part in experimental or therapeutic medical research, etc.). Whether or not one is politically correct about abortion and fetal research, it would seem prudent to firmly focus our attention on these "redefinitions" of "personhood" which could be applied to *adult* human beings as well.

B. Shifting definitions of related scientific terms

A comparison of several of the basic definitions related to the terms "pre-embryo" and "abortion" that Moore uses in the third and fifth editions will demonstrate considerable contradiction and confusion. These shifting definitions would subtly support his inclusion of the erroneous term "pre-embryo" in that later edition. Once the early human embryo is relegated to a non-person, i.e., a "pre-embryo", then it is logical to give the sort of abortion counseling which is also found in the text.

In comparing the two editions, an attempt will be made to determine during which time period this supposed "pre-embryo" might exist, as well as when the "embryo" begins to exist. In analyzing these texts, there seems to be a subtle effort to dissociate and eliminate from the fifth edition any terminology which would indicate an integral relationship between the developing human before the

embryonic period, and the developing human after the embryonic period. Additionally, it is practically impossible to determine from these texts exactly when the "embryo" itself actually begins. Even a look at the differences in the titles of the various chapters in the Table of Contents is instructive.

Third Edition

Table of Contents (pp. ix-x)

- Chapter One: Introduction
- Chapter Two: Beginning of Human Development
(first week)
- Chapter Three: Formation of the Bilaminar Embryo
(second week)
- Chapter Four: Formation of the Trilaminar Embryo
(third week)
- Chapter Five: The Embryonic Period
(four to eight weeks)
- Chapter Six: The Fetal Period
(from the ninth week to birth)

Fifth Edition

Table of Contents (pp. vii-viii)

- Chapter One: Introduction
- Chapter Two: The Beginning of Human Development
(first week)
- Chapter Three: Formation of the Bilaminar Embryonic Disk:
(second week)
- Chapter Four: Formation of the Human Embryo
(third week)
- Chapter Five: Development of Tissues, Organs and Body Form
(four to eight weeks)
- Chapter Six: The Fetal Period
(from ninth week to birth)

Note that in the third edition, the clear unambiguous term "embryo" is used in both the second and third weeks. That is, in chapter three the subject is the *bilaminar* embryo; in chapter four the subject is the *trilaminar* embryo. However, in the fifth edition, the clear unambiguous term "embryo" is not used until chapter four which concerns the third week only, where the subject is the formation of the "human embryo". Note also that the "embryonic period" is from 4-8 weeks in the third edition; the fifth does not mention the "embryonic period" at all.

In reference to the fifth edition, does this mean that before three weeks (21 days) there is no embryo - i.e., a "pre-embryo"? And in reference to the third edition, how can the embryonic period be from 4-8 weeks, when it has already begun at 2 (or 3) weeks? Why doesn't the "embryonic period" start when the embryo starts - at 2 (or 3) weeks? Would the "pre-embryo", then, be from fertilization to 2 weeks, 3 weeks or up to the beginning of the 4th week (28 days)? So far the candidates for the "pre-embryo" period are 2 weeks (14 days), 3 weeks (21 days) or 4 weeks (28 days). If what is before the 4th week is not an embryo, but is a "pre-embryo", then would abortion and fetal research be permissible up to the 4th week? This would also mark the "pre-embryo" period much later than the implantation stage (5-6 days) or the 14-day stage which several writers claim is the biological marker event of "personhood". When precisely, then, is the "embryonic period"?

Third Edition

- Introduction (p. 1)
- Prenatal Period. . . Note that the most striking advances in development occur during the first eight weeks, in which the embryonic period is included.

Fifth Edition

- Introduction (p. 1)
- Prenatal Period. . . Study of these timetables reveals that the most striking advances in development occur during the third to eighth weeks, which is known as the embryonic period.

Thus the third edition implies that the "embryonic period" is included in the first 8 weeks, but not necessarily from the stage of fertilization. The fifth edition states that the "embryonic period" extends from the 3rd to the 8th week - which contradicts the third edition's claim of 4-8 weeks. This, again, would allow for a "pre-embryo" either from the stage of fertilization to the 3rd week (21 days) in the fifth edition - or to the 4th week (28 days) in the third edition. Which is it? And when does an embryo begin? Either sometime during the first 8 weeks; or at the third week (21 days)?

Even the definition of the term "embryology" - the subject matter of these text books - is confusing. In Moore's own words:

Third Edition

Scope of Embryology (p. 7)

The term embryology can be misleading; literally, it means the study of an embryo (second to eighth weeks, inclusive). However, embryology refers to the study of both the embryo and the fetus, that is, the study of prenatal development.

Fifth Edition

Scope of Embryology (p. 7)

Embryology literally means the study of embryos (third to eighth weeks, inclusive); however, the term generally refers to prenatal development, i.e., the study of both embryos and fetuses...

Here we have the third edition clearly stating that an embryo exists from 2-8 weeks (14-56 days); and the fifth edition stating that an embryo exists from 3-8 weeks (21-56 days). And in both editions, "embryology" is defined as a science which only studies embryos and fetuses - which then would not include the "developing human" from the stage of fertilization to 2,3 or 4 weeks (depending on the page or edition) - i.e., a "pre-embryo"! Aside from this contradictory and confusing scientific account of "the developing human", what science, then, would have as its subject matter "the developing human" from the stage of fertilization to the stage of "embryo"? Is there a "new science" which would have as its subject matter the study of the "pre-embryo" only? Is this a new classification of the sciences?

Thus, there seems to be a distancing between the stages of fertilization and the embryonic period (i.e., a "pre-embryo" stage) in the fifth edition. There is also the surprising claim that the embryo itself does not begin until the third, or fourth, week - i.e. 21-28 days - a period well after even the 14-day stage of "personhood" argued for by Grobstein and McCormick (Grobstein also argues for "personhood" at a much later time). That is, now the "pre-embryo" stage could literally extend up to the third or fourth week, and not just up to the time of implantation (5-7 days) or the formation of the primitive streak (14-days).

There is also a gradual shift in terminology to isolate the "embryo" from the later "fetal" stage, as well as subtle changes in references to "abortion". For brevity, let me simply set out some of the different definitions which are ultimately related to the use of the term "pre-embryo" and of the term "abortion".

1. "Abortion"

This term refers to the birth of an embryo or a fetus before it is viable (mature enough to survive outside the uterus). . .

All terminations of pregnancy that occur before 20 weeks are called abortions. About 15% of all recognized pregnancies end in spontaneous abortions (ones that naturally occur), usually during the first 12 weeks. Legal induced abortions are brought on purposefully usually by suction curettage (evacuation of the embryo and its membranes from the uterus).

If the term "abortion" applies only to the terminations of pregnancies up to 20 weeks, does that mean that the terminations of pregnancies after 20 weeks are not to be classified as "abortions"? What are they to be classified as? And if the term "abortion" applies only to the birth of an embryo (or a fetus), does that mean that it would not be applied to the termination of a "whatever" that comes before the "embryo" stage? In the third edition, the first part of the reference applies the term "abortion" to all terminations of pregnancy that occur before 20 weeks, which would imply that the termination of a fetus would also be considered an abortion. In the latter part of the reference, the term applies only to the embryo, and not to the fetus as well. The same is true for the fifth edition. Thus the latter parts of the definitions of the term "abortion" would not refer to either the so-called "pre-embryo" or to the fetus! Also, note the fifth edition adding reasons for induced abortions, e.g., the birth of a severely malformed child [such as an anencephalic child].

2. "Abortus"

This term describes any product or all products of an abortion. An embryo or a non-viable fetus and its membranes weighing less than 500 grams is called an abortus.

1. "Abortion"

This term refers to the birth of an embryo or a fetus before it is viable (capable of living outside the uterus). Threatened abortion is a common complication in about 25% of clinically apparent pregnancies. Despite every effort to prevent abortion, about 1/2 of these pregnancies ultimately abort.

All terminations of pregnancy that occur naturally or are induced before 20 weeks are abortions. A complete abortion is one in which all the products of conception have been expelled from the uterus. About 15% of all recognized pregnancies end in spontaneous abortions (i.e., they occur naturally), usually during the first 12 weeks. Legally induced abortions, often called elective abortions, are usually produced by suction curettage (evacuation of the embryo and its membranes from the uterus). Some abortions are induced because of the mother's poor health or to prevent the birth of a severely malformed child (e.g., one without most of its brain).

2. "Abortus"

This term refers to the products of an abortion (i.e., the embryo/fetus and its associated membranes, such as the amnion and chorionic sac). An embryo or nonviable fetus and its membranes weighing less than 500 grams is called an abortus, but often one refers to them as aborted embryos or fetuses.

The term "abortus", like the term "abortion", does not refer to a so-called "pre-embryo" either. It does still refer to both embryos and fetuses in both editions.

But when the above term "abortion" refers only to an embryo (and not also to a fetus), then the term "abortus" could not refer to the fetus as well. Thus, if one were going by the latter part of the definition of "abortion", if a fetus were to be terminated, the fetus would not be referred to as an "abortus". Thus, again, the so-called "pre-embryo" is left out of the definition of the term "abortus"; and the fetus could be left out of the term "abortus" if one wanted to use the latter terminology of "abortion".

Note also that the fifth edition now includes a reference to the "associated membranes" as inclusive of the amnion and the chorionic sac. As noted earlier, Moore was contradictory in his earlier and later chapters about the intermingling of the two cell layers of the blastocyst. In his earlier chapters he stated that all of the cells of the trophoblast layer are discarded after birth as the placental membranes, etc. In his later chapters he stated that this was true with the exception of cells from the yolk sac and allantois — cells derived from the trophoblast, both of which he traces to the later embryo, fetus and adult human being. In this present statement here he adds a reference to "membranes" which are part of the abortus — but neglects to mention these two cell types of the trophoblast which are later incorporated into the embryo, fetus and adult. The attention in this fifth edition to these membranes which were of such interest and importance to Grobstein and McCormick is interesting enough. His failure to mention the yolk sac and the allantois, along with the amnion and the chorionic sac, is disingenuous at best.

3. "Zygote"

This cell results from fertilization of an oocyte, or ovum, by a sperm, or spermatozoon, and is the beginning of a human being.

3. "Zygote"

This cell results from fertilization of an oocyte by a sperm. A zygote is the beginning of a new human being.

At least Moore still acknowledges here that the zygote is the beginning of a "developing human being". The questions for some (e.g., Grobstein and McCormick) is whether or not it is also a human "person". It could also be very confusing for Moore to use the simplistic term "oocyte". There are primary and secondary "oocytes", and ova — all very different terms depicting different stages during oogenesis and fertilization. Since a primary oocyte has not proceeded through the first meiotic division (which won't happen until after puberty) and still contains 46 chromosomes (instead of 23 chromosomes), it cannot yet be fertilized by a sperm, and so they would not be usable yet in *in vitro* "therapy". Given the studies proposed in Scotland to use the "eggs" from aborted female fetuses in *in vitro* fertilization "therapies" for post-menopausal women, such a distinction would be very critical. Those "aborted eggs" cannot be fertilized, because each of them still contains 46 chromosomes.

4. "Blastocyst"

After the morula enters the uterus, a cavity develops inside it and fills with fluid; this converts the morula into a blastocyst.

4. "Blastocyst"

After the morula enters the uterus from the uterine tube, a fluid-filled cavity develops inside it; this converts the morula into a blastocyst. Its centrally located cells called the embryoblast or inner cell mass, will form the embryo.

Without repeating, the fifth edition again seems to be focusing on the issue argued by Grobstein and McCormick - i.e., that *only* the cells from the embryoblast (inner cell layer) of the blastocyst will form the embryo - *not* the cells from the trophoblast layer. Yet, as already indicated, Moore contradicts those claims in his later chapters.

5. "Embryo"

This term refers to the developing human during the early stages of development. The term is usually not used until the second week, after the embryonic disc forms . . . The embryonic period extends until the end of the eighth week, by which time all major structures are present.

5. "Embryo"

This term refers to the developing human during its early stages of development. The term is not usually used until the middle of the second week. The embryonic period extends to the end of the eighth week, at which time the beginnings of all major structures are present.

Here we have the embryo beginning both the "second" week, and the "middle of the second" week. The third edition contradicts its own Table of Contents in which the "embryonic period" is defined as from four to eight weeks. The fifth edition contradicts its own previous claim of 3 weeks. Both editions contradict each other.

- next, "Fetus"

[in the Table of Contents, this stage extends from the ninth week to birth]

7. "Conceptus"

This term refers to the EMBRYO (OR FETUS) and its membranes, the products of conception. It includes all structures that develop from the zygote, both embryonic and extraembryonic. Hence it includes not only the EMBRYO OR FETUS, but also the embryonic or fetal membranes.

6. "Conceptus"

This term refers to the EMBRYO and its membranes, i.e., the i.e., products of conception or fertilization. It includes all structures that develop from the zygote, both embryonic and extraembryonic. Hence it includes the EMBRYO as well as the fetal part of the placenta and its associated membranes, e.g., the *amnion* and *chorionic sac* . . .

7. - "Fetus"

[In the Table of Contents, this stage extends from the ninth week to birth]

Note now that while in the third edition the term "conceptus" refers to the embryo and fetus, in the fifth edition it refers only to the embryo, and not also to the fetus. Note also the same elaboration of the placenta and its associated membranes (the *amnion* and *chorionic sac*) - with no mention of the *yolk sac* and the *allantois*. The shift in the ordering of the term "fetus" will be addressed later.

If we are not totally confused yet as to what a "pre-embryo", an "embryo" or a "conceptus" is - or when each of these begins to form, or what an "abortion" is (and exactly what it is that is being aborted), consider the end of Chapter One (p. 12), where (as in every chapter) there is a set of "clinically oriented problems" or "questions" prepared for the bright inquiring medical or graduate biology student.

Third Edition

Question 3: Differentiate between the terms conceptus and abortus.

Answer (p. 446): The term "conceptus" is used when referring to an embryo or a fetus and its membranes, i.e., the products of conception. The term "abortus" refers to any product or all products of an abortion, e.g., the embryo (or part of it) and/or its fetal membranes and placenta (or parts of them).

Fifth Edition

Question 3: How does a conceptus differ from an "abortus"?

Answer (p. 458): The term "conceptus" is used when referring to an embryo and its membranes, i.e., the products of conception. The term "abortus" refers to any products or all products of an abortion, e.g., the embryo (or part of it) and/or its membranes and placenta (or parts of them). An abortion, therefore is an aborted conceptus.

Now, this is really confusing. One has to wonder how these bright inquiring medical or graduate biology students ever study for their exams. First of all, neither the third edition nor the fifth edition refer to a so-called "pre-embryo", or whatever comes before the embryo (whenever that is). Thus a "pre-embryo" is not aborted, nor is it called an abortus or a conceptus. Second, in the fifth edition, now an "abortus" is an aborted "conceptus", and an aborted "conceptus" is only an embryo! That is, since a fetus is not included in the definition of a "conceptus", the term "abortus" does not apply to an abortion of a fetus either. This is why, in the listing of these terms, the third edition lists the term "fetus" before the term "conceptus", while in the fifth edition, the term "fetus" is listed after the term "conceptus"! For some reason the latter part of the term "abortion", and the terms "abortus" and "conceptus" in the fifth edition *do not refer to the fetus*.

Now a fetus cannot be referred to as having been aborted, or referred to as an abortus or a conceptus. If it is aborted, then what is it to be referred to as? And how could it not be considered a conceptus (i.e., the product of conception)? If it is not the product of conception, then what is it the product of? I suppose that if IVF is ever really perfected, neither the act of intercourse nor the mother's womb would be necessary, and the fetus would truly be considered the "product of IVF". Perhaps that could be the "subject matter" of the "new science" that the present science of embryology (by definition) does not study — along with the study of the "pre-embryo". "Embryology", then would really only study "embryos" — period. Eventually I suppose we could do away with all of the above related terms, since there would technically be nothing to which the terms "abortion", "abortus" or "conceptus" could refer — since no women would have to be "pregnant". Indeed, I am sure that the work on the "artificial placenta" will ensure that. What a brave new world!

Second, in the main text of the third edition, there is no difference between a "conceptus" and an "abortus"; and both terms refer to both an embryo or a fetus. Yet in this "clinically oriented question", a "conceptus" still refers to *both* an embryo and a fetus; but an "abortus" now refers *only* to an embryo. Thus the third edition is contradicting its own definitions. In the main text of the fifth edition, the term "conceptus" refers *only* to the embryo, and the term "abortus" refers to *both* the embryo and the fetus. Yet in its "clinically oriented question", both terms refer only to the embryo and not to the fetus. Part of our confusion may be resolved, however, when we get to the "study" questions at the end of Chapter Two. The following question and answer do not appear in the third

edition; only in the fifth edition:

Question 5 (p. 38): A young woman who feared that she might be pregnant asked about the so-called "morning after pills" . . . What would you tell her? Would termination of such an early pregnancy be considered an abortion?

Answer 5 (p. 458): Postcoital birth control pills . . . will usually prevent implantation of the blastocyst . . . Pregnancy occurs but the blastocyst does not implant. The term abortion would not be applied to such an early termination of pregnancy.

"The term abortion would not be applied to such an early termination of pregnancy!" And so, presumably, one can terminate "it" and still not have had an abortion! How is this explainable? Is it that, unless the embryo (or "pre-embryo") has implanted, then the woman is not yet "pregnant"? It would seem not, since the answer states "such an early termination of pregnancy". Thus, presumably Moore acknowledges, at least, that the woman is pregnant. No, it would seem that it is because the woman's stage of pregnancy is "early". But what does "early" have to do with it? I would argue that just as Grobstein and McCormick use the term "pre-embryo" in order to justify experimentation on the early blastocyst (and actually until the 14-day stage), here Moore has set up the terms with such confusion, and incorporated in this edition the erroneous term "pre-embryo", in order to justify the termination of the "early developing human being" without calling it "abortion". Now it is scientifically justifiable to use the "morning after pills" - which Moore admits does not prevent fertilization, but only implantation - to eliminate what is basically, after all, only a "pre-embryo" - i.e., a non-person - if one is "fearful" that one is experiencing an "early" pregnancy! The term "pre-embryo", then, would also justify the use of the French pill RU-486! The term would also justify the use of these early developing human beings in experimental research.

So, amid this confusion of contradictory and inconsistent definitions and terms, the concrete result is that what most of us refer to as "abortion" is scientifically justified. "Abortion" during "early pregnancy" simply disappears. I suppose such an "early pregnancy" might be termed a "*pre-pregnancy*"! And with these "redefinitions" goes the guilt, regrets, and moral rebukes that women may fear from the termination of these "early" pregnancies. Note that "abortion" of a fetus also disappears! The term "abortion" no longer can be referred to the termination of a fetus; it will be restricted to the embryo only. Perhaps the termination of a fetus will be called a "post-pregnancy". Perhaps we also need to clarify exactly what is meant by the term "pregnancy". What is a "pregnancy"? Does it only have reference to the woman, and not to what she is pregnant with? How is the critical term "pregnancy" defined?

"Pregnancy": the Case of the Missing Definition

It would seem at this point that a relevant "clinically orientated question" to be addressed to the bright inquiring medical and graduate biology students is: "How would you define 'pregnancy'?" If before implantation (5-6 days) - (or 2,3 or 4 weeks) - there is only a "pre-embryo", and therefore a "pre-pregnancy", how

then does one define a "pregnancy"? After all, abortion is commonly understood as the termination of a pregnancy - right? Well, then, scientifically speaking, just when does a woman become "pregnant"?

Again Moore is extremely confusing and contradictory. In fact, a thorough search of both the third and the fifth editions of Moore's text books reveal *no formal definition of the term "pregnancy"*! Imagine, an embryology text book, replete with virtually thousands of formal definitions about the developing human and the female uterus . . . Imagine, a counsel to students that the term "abortion" would not apply to such as "early termination of pregnancy" - or to the termination of a fetus either, for that matter - and no definition of "pregnancy"! Even an attempt to decipher one amid the various contexts in which the term is used is, once again, contradictory and confusing. Indeed, both fertilization and implantation (or later) are implied:

Third Edition

NOT MENTIONED

About 15% of all zygotes result in detectable spontaneous abortion, but this estimate is undoubtedly low because the loss of zygotes during the first week is thought to be high. The actual rate is unknown because the women do not know they are pregnant at this early stage. (p. 36)

It would seem here that "pregnancy" begins at fertilization. The pregnancy tests imply the detection of pregnancy during the first week. The terms "zygote" and "blastocyst" are used which also indicate 1-7 days. Note also the reference that zygotes and blastocysts "abort" during this earliest of early stages. Yet recall the abortion counseling, i.e., the term "abortion" would not apply to such an "early" stage of pregnancy. Confusing?

NOT MENTIONED

IBID
(p. 46-48)

IBID
(p. 48)

Fifth Edition

Within 24-48 hours after fertilization an immunosuppressant protein, known as the early pregnancy factor (EPF), appears in the maternal serum. EPF forms the basis of pregnancy tests during the first week of development (p. 32)

At least 15% of zygotes die and blastocysts abort . . . Another 30% of women abort very early, unaware that they were pregnant (p. 36)

Enough hCG is produced by the syncytiotrophoblast at the end of the second week to give a positive pregnancy test even though the woman is probably unaware she is pregnant. (p.40)

Implantation of the blastocyst usually occurs in the endometrium of the uterus. If implantation occurs elsewhere, a misplaced or ectopic pregnancy results. (p. 43)

Intrauterine pregnancy can be detected by highly sensitive radioimmune assays of hCG as early as the end of the second week . . . The blastocyst may implant outside the uterus. These implantations are referred to as ectopic pregnancies. (p. 46)

Here pregnancy is detectable by the end of the second week. And the woman is pregnant at least by the time of implantation (5-7 days).

Third Edition

The administration of relatively large doses of estrogen (morning-after pills) for several days after sexual intercourse will prevent pregnancy by inhibiting implantation of the blastocyst that may develop. (p. 49)

Relatively simple and rapid tests are now available for detecting pregnancy as early as the third week. These tests depend on the presence of human chorionic gonadotropin (hCG), a hormone produced by the trophoblast and excreted in the mother's urine . . . There is no absolute sign of pregnancy during the early weeks because a gravid (pregnant) uterus may be mimicked by several other conditions. (p. 53)

Does "will prevent pregnancy by inhibiting implantation" mean that unless implantation has taken place a woman is not pregnant and that if implantation does take then she is pregnant? The reference to a "gravid (pregnant) uterus" would seem to imply this also. This would contradict the first of these references, which imply strongly that a woman is pregnant from fertilization on.

Almost all abortions during the first three weeks occur spontaneously; that is, they are not induced. The frequency of early abortions is difficult to establish because they often occur before the woman is aware she is pregnant. (p. 49)

The third edition acknowledges that "early" abortions may occur during the first three weeks, a contradiction of the fifth edition's abortion counseling about "early pregnancies". The fifth edition only refers now to abortions of embryos during the first three weeks, implying that the terms of "zygote" and "blastocyst" would not be considered "abortions". Yet simultaneously it uses the term "early abortions" during this 3 week period "before women are aware they are pregnant". One is still hopelessly confused as to exactly when "pregnancy" begins, how it is defined, and what it is a woman is pregnant with.

Third Edition

Question 2: A 25-year old woman with a history of regular menstrual cycles five days was overdue on menses. Owing to her mental condition and the undesirability of a possible pregnancy, the doctor decided to do a "menstrual extraction", or uterine evacuation. The tissue removed was examined for evidence of a pregnancy. What findings would indicate an early pregnancy? How old would the products of conception be? (p. 68)

Fifth Edition

The administration of relatively large doses of estrogen ("morning-after pills) for 5 days, beginning 72 hours after sexual intercourse, will usually prevent pregnancy by inhibiting implantation of the blastocyst (pp. 49-50)

Relatively simple and rapid tests are now available for detecting pregnancy. Most tests depend on the presence of an early pregnancy factor (EPF) in the maternal serum . . . and human chorionic gonadotropin (hCG), . . . (p. 53)

Most abortions of embryos during the first three weeks occur spontaneously; i.e., they are not induced . . . The frequency of early abortions is difficult to establish because they often occur before women are aware that they are pregnant. (p. 49)

Fifth Edition

IBID
(p. 68)

Answer 2: The presence of embryonic and/or chorionic tissue in the endometrial remnants would be an absolute sign of pregnancy, but this tissue would be very difficult to find at such an early stage of pregnancy. By five days after the expected menses, i.e., about five weeks after the last menstrual period, the embryo would be in the third week of its development. (p. 448)

Here, in the third edition an absolute sign of pregnancy corresponds with a 3-week embryo which has implanted. Also, in the fifth edition, the term "blastocyst" is added. However, a blastocyst (5-7 days) predates an embryo (2,3 or 4 weeks) and has not necessarily implanted as yet. Thus there could be no "embryonic and/or chorionic tissue" present. Besides, I thought a blastocyst was really a "pre-embryo", and therefore would be no abortion, no abortus, no conceptus, and no pregnancy! Really confusing. But to continue.

Question 2: A woman who had been raped during her fertile period was given large doses of estrogen. . . (DES) twice daily for five days) to interrupt a possible pregnancy. If she happened to be pregnant, what do you think would be the mechanism of action of the DES? What do laypeople call this type of treatment? (p. 51)

Answer 2: DES appears to affect the endometrium by rendering it unsuitable for implantation, a process regulated by a delicate balance between estrogen and progesterone. The large dose of estrogen given to the patient upset this balance. Progesterone makes the endometrium grow thick and succulent so that the blastocyst may become embedded and be nourished adequately. . . DES pills are referred to as "morning after pills" by laypeople. (p. 447)

IBID, with the addition of: the blastocyst would be about 2 mm in diameter. (p. 459)

A woman who was sexually assaulted during her fertile period was given large doses of estrogen twice daily for five days to interrupt a possible pregnancy. If fertilization had occurred, what do you think would be the mechanism of action of this hormone? What do laypeople call this type of medical treatment? Is this what the media refer to as the "abortion pill"? If not explain the method of action of this pill. How early can a pregnancy be detected? (p. 50)

. . . (DES) appears to affect the endometrium by rendering it unsuitable for implantation, a process that is regulated by a delicate balance between estrogen and progesterone. The large doses of estrogen given to the patient upset this balance. Progesterone makes the endometrium grow thick and succulent so that the blastocyst may become embedded and be nourished adequately. DES pills are referred to as "morning after pills" by laypeople. When the media refer to the "abortion pill" they are usually referring to RU486. This drug, developed in France, also interferes with implantation of the blastocyst. It blocks the production of progesterone. Its use has not been authorized in North America (at the time of this writing). A pregnancy can be detected at the end of the second week after fertilization using highly sensitive pregnancy tests. Most tests depend on the presence of an early pregnancy factor (EPF) in the maternal serum. (p. 459).

In the third edition does "interrupt a possible pregnancy" imply that unless the blastocyst implants the woman is not pregnant? Yet in the fifth edition a distinction is made between fertilization having occurred and a possible pregnancy! This edition also adds the latest information on drug use. Interestingly, the "morning after pills" are not to be properly referred to as an abortion pill (as we have already seen) - and therefore one might take them, being assured that one is not causing an abortion. Why the "morning after pills" would not be referred to as abortion pills, then, has been made clear - i.e., abortion does not refer to an "early pregnancy" - i.e., when there is only a "pre-embryo" there. But why, then, would only RU486 be referred to as an abortion pill? The "entity" terminated is still a "pre-embryo" and the pills also act by preventing implantation. At least Moore should be consistent. And we still have no clue as to when "pregnancy" begins.

Connection Between Abortion and Fetal Research

If one is not a scientist, and if one wants to know what these terms mean and how they are defined, one would logically turn to a well-established and respected human embryology text book. Consider a "blue-ribbon" governmental panel, or even the new non-government independent NABER²⁵ (started with seed money from the American Fertility Society, whose board members include many of the scientists, physicians, bioethicists, lawyers and other professionals who are great proponents of abortion, IVF, fetal research, etc.) brought together to weigh and judge the appropriate "ethical" issues and responses to the various burgeoning issues in experimental research and "reproductive health" (NAROL's new emphasis and new name). Where would they turn to obtain the most reliable scientific definitions of the "entities" which are to be experimented on for medical advancement, "reproductive health" concerns, the obtaining of purely scientific knowledge not possible by any other means, and the greater good of society? One very reasonable possible scientific reference source would be Moore's text book on human embryology, especially the most recent fifth edition. And what could they find there now? That until the fourth week, i.e., 28 days, there is really only a "pre-embryo" there - a "non-person" with no ethical or legal protections. Consequently, not only could "early" abortions be acceptable up to 28 days, but also unfettered experimental research would be acceptable up to 28 days. Thus, both "pre-embryos" and "embryos" would be ethically acceptable materials on which to experiment, with no ethical squabbles or regulatory oversights. That should give us pause enough.

But what about the possible use of human fetuses in experimental research? *Moore has defined the fetal period from nine weeks to birth.* Most human embryology text books do. So certainly the early developing human being would be protected from abortion and experimental research at least up to the ninth week — right? Well, Moore has not included the fetus in his definitions of abortion, abortus, or conceptus. No - Moore's text would not protect a fetus from abortion! But luckily at least the present OPRR governmental regulations do protect the fetus. A look at the present governmental OPRR regulations, and how they define the terms "pregnancy" and "fetus" should clarify the situation and relieve this tension.

It is interesting to note that the definition of "pregnancy" in the O.P.R.R. regulations on the use of human subjects in experimental research is: "the period of time from confirmation of implantation [5-7 days] . . . until expulsion or extraction of the fetus."²⁶ Thus, theoretically, a woman is not even "pregnant" from the time of fertilization until implantation. I suppose she would be considered "pre-pregnant" with a "pre-embryo". At the present moment, then, developing human beings up to the time of implantation are not protected from destructive experimental research, as that definition stands in the OPRR regulations. If the regulations were to incorporate Moore's new term of "pre-embryo", then it could be acceptable to use developing human beings even up to the 28-day stage! Thus it is not only acceptable to "terminate" the "early pregnancy" of a "pre-embryo". It could also be acceptable to use these "terminations" in destructive experimental research. This would also apply, of course, to the products of *in vitro* fertilization. Clearly, this sets the stage for unregulated experimentation on IVF human embryos - with or without implantation. That is, even when it is planned to implant IVF human "embryos" (if that is what they are), if a scientist wants to experiment on them before implantation, then there are no regulations covering such experiments (although we will now have the expert ethical advise from NABER at our disposal).

But how do the OPRR regulations define "fetus"? A fetus is defined as: "the product of conception from the time of implantation. . . until a determination is made, following expulsion or extraction of the fetus, that it is viable."²⁷ Does this mean that the fetal stage begins at implantation? How could such a blue-ribbon governmental panel of such experts have defined the critical term "fetus" as beginning at implantation? Were they just being "cautious"?

Of great concern is that if "ethics panels" were to consult Moore's third or fifth edition, a "fetus" would not exist until the ninth week, i.e., 63 days. Could this mean that if an "ethics panel" were to square its definitions with Moore's text book, that before nine weeks the developing human being (the "pre-fetus") could be aborted, experimented on, or harvested for tissues and organs with no regulations? Consider that in his fifth edition, Moore does not use the terms "abortion", "abortus" or "conceptus" to refer to the fetus - only to the "embryo". So presumably, to terminate a "fetus" would no more be properly defined as "abortion" than was the termination of an "early pregnancy"! Would "correcting" the present "outmoded" definition of "fetus" in the present federal regulations, then, provide for an even longer period during the life of the "developing human" that it could be experimented on - i.e., up to nine weeks - without regulations?

Coincidentally, the optimum time to harvest fetal brain tissue is between eight and nine weeks - just before Moore's cut-off point of nine weeks in his definition of a "fetus"! Given the new grants to several research institutions to use fetal brain tissue in research on Parkinson's disease, Alzheimer's disease, and several other neurological and brain disorders, the future looks grim for "developing human beings". What further developing "definitions" are in store for us in the future? Who else will be scientifically defined away as "pre-persons" or "non-persons" for the sake of basic and medical researchers? Could it be those very desperate

adult human subjects who have Parkinson's disease, Alzheimer's disease, who are comatose, mentally ill, paraplegic, drug addicts, etc. - i.e., those human beings who do not exercise "rational attributes" or sufficient "sentience", and who are therefore not human persons? What an incredible scenario! Basic and medical researchers experimenting on two classes of human beings, neither of which are human "persons" - with no regulations or ethical dilemmas! Their "personhood" has been defined away! And nobody did anything about it.

Conclusion

Whether such contradictory and confusing scientific definitions of important basic terms used in human embryology occur because of ignorance, sloppiness, or design is debateable. Certainly the massive amounts of contradictory definitions presented in these texts would warrant a similar analysis of many other basic scientific and medical texts being used by professionals and students alike. It would appear to this writer that these various key definitions are being "ratcheted" in order to scientifically justify both abortion and fetal research. This is the ultimate in the on-going politization of science. And unless the errors and inconsistencies are corrected immediately, we are not only entering a protracted period of "false concepts concerning our own development"; we are entering a protracted period of abysmal abuse of human beings - pre-born and adult. The stage has already been set.

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