When Human Life Begins

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ABSTRACT: The predominance of human biological research confirms that human life begins at conception—fertilization. At fertilization, the human being emerges as a whole, genetically distinct, individuated zygotic living human organism, a member of the species Homo sapiens, needing only the proper environment in order to grow and develop. The difference between the individual in its adult stage and in its zygotic stage is one of form, not nature. This statement focuses on the scientific evidence of when an individual human life begins.

It has been recognized for millennia that both a paternal (semen) and a maternal contribution are required for the formation of a new human life. The first recorded embryological reports are in the fifth century B.C. books of Hippocrates, who noted from the study of incubating chicken eggs that the nature of the bird can be likened to that of the man. A century later, Aristotle studied the chick and other embryos but incorrectly thought that they arose from a formless mass of semen combined with menstrual blood. In 1677, Hamm and Leeuwenhoek observed spermatozoa under the microscope, but thought they contained miniature humans. Spallanzani demonstrated in 1775 that both oocyte and sperm were necessary. In 1827, von Baer observed oocytes in the ovarian follicle and in the Fallopian tube and blastocysts in the uterus of a dog. [1]

Finally, it was with the advent of the cell theory developed by Schleiden and Schwann in 1839 that it was recognized that the embryo develops from the single-celled zygote.[1] Directly based upon this observation and the knowledge that the single-celled zygote was alive and an independent being, in 1859 the American Medical Association published a statement strongly opposing abortion, particularly commenting on the independence of the zygote during the time between its formation and its implantation. [2,3]

Although the American College of Obstetrics and Gynecology in 1965 attempted to redefine "conception" to mean implantation rather than fertilization,[4] medical dictionaries and even English language dictionaries both before and after 1966[5,6] define "conception" as synonymous with fertilization (sometimes via the intermediary term of "fecundation").[7,8,9] Moore's 1974 edition of a human embryology textbook states that development is a continuous process that begins when an ovum is fertilized by a sperm and ends at death. It is a process of change and growth that transforms the zygote, a single cell, into a multicellular adult human being.[10] Moore's 2008 edition emphasizes that development does not end at birth but extends into early adulthood.[1] Professor Emeritus of Human Embryology of the University of Arizona School of Medicine, Dr. C. Ward Kischer, affirms that "Every human embryologist, worldwide, states that the life of the new individual human being begins at fertilization (conception)." [11] Even authors who philosophically lean towards not attributing the same value to human life at the one-cell stage as they do to later stages of development admit that "As far as human 'life' per se, it is, for the most part, uncontroversial among the scientific and philosophical community that life begins at the moment when the genetic information contained in the sperm and ovum combine to form a genetically unique cell." [12]
J. T. Eberl goes on to say – and this is really the debate:

"However, what is controversial is whether this genetically unique cell should be considered a human person."

Nonetheless, one could sensibly make the case that "personhood" can only exist in a living human being and that the division of these two entities is arbitrary at best.

In the last century, and particularly in the last decades, much more detailed observation has been made of the first 24 hours of the life of a human being. During this time the cell membranes of a sperm and ovum fuse and the first cell division occurs. When during this 24 hours does, a new human life begin? Embryologists are less united on this question. This Statement aims to clarify this issue.

During the first 24 hours, once the sperm and egg bind to each other, the membranes of these two cells fuse, creating in less than a second a single hybrid cell: the zygote, or one-cell embryo.[13,14] To protect his or her bodily integrity, within minutes the zygote initiates changes in its ionic composition, releasing zinc in a spark that induces "egg activation," first modifying the surrounding zona pellucida blocking further sperm binding to the cell surface.[15,16,17] Cooperation between sperm and egg components to achieve replication of DNA, cell division, and growth occurs as maternally and paternally derived factors in the zygote begin interacting with and chemically modifying each other to initiate the final round of meiotic division in the maternally derived nucleus[15,16] to enable DNA replication.

Finally, the nuclear membranes of the pronuclei break down (called syngamy—technically, pronuclear membranes). No new nuclear membrane encompassing both pronuclei is formed; rather, mitosis occurs and two cells, each with its own identical nucleus encased in a nuclear membrane, are formed.[18]

Furthermore, studies with mice embryos demonstrate that despite the plasticity of which allows disrupted blastomeres to form an entire organism, ordinarily the polarity of the embryo is determined by the site of sperm penetration.[19,20] (Evidence from other mammalian species suggests that the same may be true in humans, but does not offer definitive proof).

Some embryologists consider fertilization a day-long process and regard the beginning of human life as occurring near the end of this process at syngamy,[1,18,21] whereas others consider the time of cell membrane fusion when the embryo gives evidence of being a different kind of cell than either oocyte or sperm, to be the beginning of a new human life, since within minutes the new embryo acts to prevent the merger of another sperm with itself and starts the business of self-replication. The single-celled embryo is a very different kind of cell than that of sperm or oocyte, and contains a unique genome that will determine most future bodily features and functions of his or her lifetime.

An organism is defined as "(1) a complex structure of interdependent and subordinate elements whose relations and properties are largely determined by their function in the whole, and (2) an individual constituted to carry on the activities of life by means of organs separate in function but mutually dependent: a living being." [22]

It is clear that from the time of cell fusion, the embryo consists of elements (from both maternal and paternal origin) which function interdependently in a coordinated manner to carry on the function of the development of the human organism. From this definition, the single-celled embryo is not just a cell, but an organism, a living being, a human being.

The American College of Pediatricians concurs with the body of scientific evidence that corroborates that a unique human life starts when the sperm and egg bind to each other in a process of fusion of their respective membranes and a single hybrid cell called a zygote, or one-cell embryo, is created.

As physicians dedicated both to scientific truth and to the Hippocratic tradition, the College values all human lives equally from the moment of conception (fertilization) until natural death. Consistent with its mission to "enable all children to reach their optimal physical and emotional health and well-being," the College, therefore, opposes active measures[23] that would prematurely end the life of any child at any stage of development from conception to natural death.

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The American College of Pediatricians is a national medical association of licensed physicians and healthcare professionals who specialize in the care of infants, children, and adolescents. The mission of the College is to enable all children to reach their optimal physical and emotional health and well-being.

References

[1] Moore KL, Persaud TVN. *The Developing Human*, 7th ed. Philadelphia: Saunders-Elsevier, 2003; 31; Carlson BM, *Human Embryology and Developmental Biology*, 3rd ed. Philadelphia: Mosby-Elsevier, 2004; 2, 8-10, 31.

[2] Report on Criminal Abortion, *JAMA*, Vol XII-6, 1859. Three causes for abortion were listed: first "a widespread popular ignorance of the true character of the crime – a belief, even among mothers themselves, that the fetus is not alive until after the period of quickening." "Abundant proof upon each of these points has been prepared by the committee, and is elsewhere* being published"; and concluded "In accordance, therefore with the facts in the case…publicly express its abhorrence of the unnatural …crime of abortion; that it avow its true nature, as … the wanton and murderous destruction of her child" and called for revision of current laws. The AMA unanimously approved this resolution.

[3] North American Medico-Chirurgical Review, Jan. 1859, et seq. "If the foetus be a lifeless excretion, however soon it might have received life, the offence is comparatively as nothing; if the foetus be already, and from the very outset, a human being, alive, however early its stage of development, and existing independently of its mother, though drawing its sustenance from her, the offence becomes, in every stage of pregnancy, MURDER. …..the ovum does not originate in the uterus; that for a time, however slight, during its passage through the Fallopian tube, its connection with the mother is wholly broken; that its subsequent history is one merely of development, its attachment merely for nutrition and shelter, it is not rational to suppose that its total independence, thus one established, becomes again merged into total identity…or that life…dates from any other epoch than conception" p. 69-70.

[4] ACOG Terminology Bulletin. Terms used in reference to the fetus. Chicago. ACOG No. 1. Sept 1965. If ACOG ever published a rationale for this change, the American College of Pediatricians has been unable to find it. However, two physicians associated with Planned Parenthood shed some light upon a probable rationale. At the 1959 Planned Parenthood/Population Council symposium, Dr. Bent Boving argued for changing the definition by moving the date of conception *from* when fertilization occurs *to* when implantation occurs. He said that "the social advantage of [birth control] being considered to prevent conception rather than to destroy an established pregnancy could depend upon something so simple as a prudent habit of speech."[1] Bent Boving, "Implantation Mechanisms," in Mechanics Concerned with Conception, ed. C.G. Hartman (New York: Pergamon Press, 1963), p. 386. Accessed from https://en.wikipedia.org/wiki/Beginning_of_pregnancy_controversy.

In 1964, Dr. Christopher Tietze noted that that many religious and legal experts accept medical consensus as fact, and said that "if a medical consensus develops and is maintained that pregnancy, and therefore life, begins at implantation, eventually our brethren from the other faculties will listen."[2] Tietze would later win the Planned Parenthood Federation of America Margaret Sanger Award for outstanding contributions to the pro-abortion movement. Proceedings of the Second International Conference, Intra-Uterine Contraception, October 2-3, 1964, New York, ed. Sheldon Segal, et al.., International Series, Excerpta Medica Foundation, No. 86, p. 212. Accessed from https://en.wikipedia.org/wiki/Beginning_of_pregnancy_controversy.

[5] The American College Dictionary, Random House, NY: 1956. p. 249.

[6] Stedman's Medical Dictionary, Williams and Wilkins Co. 21st ed, Baltimore 1966. pp. 352,583,586.

[7] Webster's New International Dictionary of the English Language Unabridged, Merriam-Webster, Encyclopedia Britannica, 1986. pp. 469.

[8] Merriam-Webster Deluxe Dictionary, 10th collegiate Ed., Readers Digest, Pleasantville, NY, 1998. pp. 373,677,671.

[9] Tabor's Cyclopedic Medical Dictionary. 14th edition, FA Davis Co, Philadelphia., 1981. p. 322.

[10] Moore KL. The Developing Human: Clinically Oriented Embryology, WB Saunders Co, Philadelphia, 1974. p. 1

[11] Kischer CW. The corruption of the science of human embryology, *ABAC Quarterly*. Fall 2002, American Bioethics Advisory Commission.

[12] Eberl JT. The beginning of personhood: A Thomistic biological analysis. *Bioethics.* 2000;14(2):134-157. Quote is from page 135.

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[15] Cox LJ, et al., Sperm phospholipase czeta from humans and cynomolgus monkeys triggers Ca2+ oscillations, activation and development of mouse oocytes, *Reproduction* 124, 5, November 2002; 611-23.

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[17] Duncan FE, Que EL, Zhang N, et. al. The zinc spark is an inorganic signature of human egg activation. *Sci Reports.* 2016; 26:24737. doi:10.1038/srep24737.

[18] Condic, ML. When does human life begin? A scientific perspective. Westchester Institute White Paper 2008; 1(1) The Westchester Institute for Ethics & the Human Person, P.O. Box 78, 582 Columbus Ave., Thornwood, NY 10594 p. 5 (paraphrased).

[19] Piotrowska, K, Zernicka-Goetz, M. "Role for Sperm in Spatial Patterning of the Early Mouse Embryo," *Nature* 409 (2001): 5l7-521.

[20] Gardner, RL. "Specification of Embryonic Axes Begins Before Cleavage in Normal Mouse Development," *Development*, 128 (2001): 839-847

[21] Carlson BM. *Human Embryology and Developmental Biology*, 3rd ed. Philadelphia: Mosby-Elsevier, 2004; 36.

[22] Merriam-Webster Dictionary, http://www.merriam-webster.com/dictionary/organism. Accessed February 23, 2017.

[23] Examples of these active measures include:
--induced abortion (When the life of the mother is at risk efforts should be made to save both mother and child, recognizing that prior to viability it may be possible to save only the mother, and death of the embryo/fetus is unintentional, i.e., in cases of tubal pregnancy.)
--embryo destruction and selective reduction of embryos and fetuses in multiple gestation pregnancies
--"contraception" which adversely affects implantation and leads to the death of the embryo.