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The Silent Life: An Embryological Review

William T. O'Connell

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William T. O'Connell, M.D.

In the voluminous amount of literature that has suddenly swamped the entire world with statistics concerning over population and the imperative necessity of stopping this flash flood of humanity, little, if any, attention has been given to the one most involved with the condition: The embryo. He has been relegated to the role of sacrificial lamb led to the altar by humanitarians who have suddenly been engulfed by their desire to cure the ills of the world by reducing the human equation.

It is interesting to note that population control is not the worry of this generation alone. Methods for abortion ranged from mystical rites to trauma throughout the early ages, but the uterus itself was seldom, if ever, subject to internal manipulation. As knowledge of anatomy and operative technique improved, invasion of the uterus became more common, until Professor K. H. Mehlan, Dean of the Medical Faculty at the University of Rostock, East Germany, was able to state, at the First International Conference of Family Planning Programs held in Geneva in 1964, that Hungary achieved an apparent world record in 1964 with 218,700 registered abortions for 132,100 births, a ratio of 140 abortions to 100 births.[1]

In Belgrade, the United Nations World Population Conference was told: "Abortion, whether legal or illegal, is probably the single most important method of family limitation today."[2]

Surprisingly, the Federation of Obstetrical and Gynecological Societies in India, meeting in Bombay, agreed unanimously that legalizing of abortion would not help reduce India's birth rate and was not a suitable method of population control.[3]

The World Health Organization in 1964 announced at Geneva, Switzerland, that abortion is responsible "for an approximate average of 10 per cent of all maternal deaths."[4] They neglected to add that abortion is responsible for a fetal death rate of 100 per cent.

In a recent issue of Forbes Magazine, business men were told in an article entitled "What Population Explosion?": "The game of projecting population trends is just about as scientific as reading tea leaves." This statement is buttressed with statistics showing that while the United States marriage rate has been rising, the birth

(Dr. O'Connell, a graduate of Tufts University School of Medicine, is in private practice in obstetrics and gynecology in Boston.)

rate has been declining steadily since 1956 – from 25.2 births per 1,000 population to 18.6 births in 1966. The article further states that demographers have reduced by 100 million their prediction made a decade ago of a United States population of 400 million by the year 2000.[5] Those who advocate abortion admit that medical indications are limited; there has gradually crept into their arguments an increased stress on socio-economic reasons. There has been a subtle change in the pattern of the program with much emphasis being placed on the mental well-being of the mother and her rights. Little, if any, mention has been made on the rights of the fetus. After reviewing the literature on embryology for the past half century, my conclusion is that the embryo is a human and living being from the moment of conception and as such, has a right to life that cannot and should not be violated.

From the beginning of man's existence on earth, there has always been a deep-seated desire to solve the mystery of reproduction. The gradual groping of man's mind toward a systematic study of reproductive physiology was occasionally illuminated with small shafts of light, as we find when Anaxagoras of Clazomenae (b. about 500 B.C.) alone maintained the fetus was nourished by the umbilical veins (arteries?).[6]

The Hippocratic School of Medicine believed that when an ovum entered the uterus, the temperature of that organ rose, increasing the circulation of the air, and was essential to the maintenance of fetal life. The author of the "Peri Sarkon" believed that the fetus was fully formed by the 7th post-conceptional day.[6]

The Talmud contains many references to embryology. The organs of different body structures are attributed to both the father, "Who sows the white" (bones, tendons, nails, marrow, and white of the eye, and to the mother, "Who sows the red" (the skin, flesh, blood, hair, and dark part of the eye). Fetal sex depended on whether "At coitus the male or female seed entered the womb first. It was believed that the fetus was developed at the end of the 6th week.[6]

The Byzantine School, represented by Oribasios and Galen, in spite of many advances, did not recognize the fact that the ovary expelled the ovum. Conversely, the Medical School of Salerno, in the Anatomy of Cophon, notes that on either side of the uterus are the testicles (ovaries) attached to the uterus "by which the male seed is transmitted to the uterus."

Surprisingly, it was not a physician, but a philosopher, who laid the foundations of comparative anatomy and embryology. Aristotle investigated the development of the chick within the egg, and the result of these investigations was the first of a vast series of embryological researches during subsequent ages.[6]

Harvey, in his second great work, "De Generatione Animalium," also published the results of embryologic research.[7]

The progress of embryology was slow due, perhaps, to a reluctance to probe the mysteries of life or perhaps to a lack of investigators with sufficiently inquisitive minds. It was not until the nineteenth century that embryology received its chief stimulus from Carl Ernst Von Baer (1792 – 1876) of Konigsberg who, in 1827, discovered the mammalian ovum.[7]

The field of embryology owes much to German anatomists, particularly F. G. Merkel (1845 – 1919) who presented the first study of the human embryo as a whole in his work "Anatomie Menschlichen Embryonen."[7]

F. P. Mall (1862 – 1917), a pupil of Merkel, stimulated the scientific study of embryology and anatomy in America. R. G. Harrison, W. Lewis, and G. L. Streeter were among his pupils.[7]

The nineteenth century saw many renowned embryologists emerge in all parts of the world. In America, Charles S. Minot (1852 – 1914), Professor of Comparative Anatomy and Embryology at Harvard, postulated his "Law of Cytomorphosis" in which he states that the aging process is due to the constant change of protoplasm into less flexible forms.[7]

In Belgium, P. I. Van Beneden, Professor of Zoology at Liege and co-discoverer of the chromosome, later (1883 – 1887) showed that these bodies were derived equally from both parents, thus advancing knowledge both of cellular division and the relation of the chromosomes to heredity.[7]

Once fertilization has occurred, there is a rapid series of cell division, and although we speak of "stages of development" in discussing the progress of events, we must realize that this is a continuous process, during which one phase merges into another without any real point of demarcation.

Arey[8] has stated that embryology is the science that treats of the origin and development of the individual organism. "Development" means in this sense a gradual beginning to completion, both in structure and in function. Its chief characteristic is cumulative progressiveness, in which each component act and result *loses significance* when viewed against what precedes and what follows.

If life begins at the moment of conception, then the resulting product of conception must exhibit the true characteristic of living tissue. I do not believe, as many claim, that it is possible to suddenly change at some phase in the reproductive process from an amorphous group of cells into a living, human being.

What is life? According to Stedman,[9] life is defined as vitality; the essential condition of being; or existence of animals and plants; the state of existence characterized by active metabolism.

Dorland[10] defines life as the aggregate of vital phenomena; a certain peculiar stimulated condition of organized matter; that obscure principle whereby *organized* beings are peculiarly endowed with certain powers and functions not associated with inorganic material. *Intra-uterine* life is the period of life spent in the uterus.

If active metabolism is one of the characteristics of existence, then we must, in turn, define metabolism. Best and Taylor[11] have defined metabolism as the term employed to describe the chemical changes that occur within the tissues. The integration of these reactions leads (1) to growth; (2) to the production of heat required to maintain body temperature; and (3) to supply the energy for other vital processes.

Arey[8] has stated that only at about the age of 25 are the last of the progressive changes finished and the

body stabilized in the adult condition. In other words, from the moment of conception until approximately 25 years of age, a series of progressive changes in the human being takes place. There is an orderly change, characterized by growth and development, not only in intra-uterine but extra-uterine life. How can we honestly say that there is a moment in this process when we change from being non-human and non-living to human and living?

In 1908, Bryce and Teacher[12] were the first to describe a specimen in the previllous stage, but this was probably an abnormal ova. It was not until 1918 that Ingalls[13] described a human embryo before the appearance of the myotomes, while in 1920, Streeter[14] described a human embryo of the presomite period.

In the ever-continuing search to trace the development of the human embryo from the moment of conception, much time has been devoted to the classification of early embryos. Streeter,[15] in 1926, described the "Miller" ovum – the youngest human embryo thus far known. Kindred,[16] in 1933, described a human embryo of the presomite period from the uterine tube, and in 1937, Brewer and Fitzgerald[17] described 6 normal and complete presomite ova, all of which were obtained from hysterectomy specimens. In none was there any abnormality of the pregnancy, and they are described as 6 normal and *complete* presomite *human* ova.

Brewer, in 1938,[18] described a human embryo in the bilaminar blastocytic stage (The Edward-Jones-Brewer ovum). The estimated age of this ovum was 15 days from conception.

The attempt to penet e the mystery of early life was con ued by Hertig and Rock,[19] who 1941 described 2 *human* ova f the previllous stage having an ulation age of about 11 and days respectively.

Enough embryos had bee studied by 1942 that Streeter was ab in that year, to outline a classifi ion of development groups of en yos to cover the first 7 weeks of e bryonic life. Chief interest has cente l on the first 8 groups, that from fertilization to the appearar of the first pair of somites. Briefly ney are: (1) one-celled stage; (2) s menting egg; (3) free blastocyst; (4) planting ovum; (5) ovum impla ed but avillous; (6) primitive vil distinct yolk sac; (7) branching vi axis of germ disc defined; (8) Hen 's node, primitive grove.

Heuser, Rock, and He g,[20] in 1945, described 2 humar embryos showing early stages of the definitive yolk sac, and again in 1945. ertig and Rock described 2 human a of the previllous stage h ving a developmental age of abo 7 and 9 days respectively. It is in resting to note that in that article erence is made to reproduction and mbryonic life in the macaque monke (Wislocki and Streeter–1938) in which placentation is similar to that in man, "But it must be emphasize that the human ovum invades the endometrium and ultimately comes to lie within the latter – the interstitial type of implantation – whereas the monkey ovum merely attaches itself to the endometrium and thus always remains partially within the uterine cavity."

Shauer,[21] in 1946, described an embryo of 2 to 3 pairs of somites removed from the uterine orifice but which is described as a normal human embryo.

In 1948, Robertson, O'Neill, and Chappell[22] were able to state: "Enough material has been collected and studied to demonstrate that there are many noteworthy differences between early human embryology and the early development of other mammalian embryos."

The search for early human embryos continued in 1948, and Hertig and Rock[23] were able, in that year, to state that eggs are fertilized soon after ovulation, usually within 12 hours.

The process of human development from the 3rd to the 7th day is, as yet, obscure, but as Hertig and Rock state, "When the ovum is twelve days old, progressive differentiation of the four tissues, already seen in their incipience, has built a sturdy young organism."[23]

In the paper by Rock and Hertig describing the conceptus during the first 2 weeks of gestation, a detailed description of the embryo is given, ending with the statement: "This somewhat amorphous two-layered *individual* (italics mine) lies within a cavity fully five times its size."[23]

In 1949, Hertig and Rock presented a series of potentially abortive ova recovered from women prior to the first missed menstrual cycle. Dr. Lyman W. Mason,[24] discussing the paper, remarked: "It must also be remembered that by the time the conceptus reaches the uterus, it is not a sperm or an ovum but a morula, composed of many cells which has been subjected to environmental factors from the time of fertilization and before."

The search for early ova continued, and in June, 1952, 2 well-preserved human ova of about the 18th day were described by West.[25] Kistner,[26] in January, 1953, described a 13-day human embryo showing early villous and yolk sac development.

In 1953, McKay, Hertig, Adams, and Danziger[27] reported on 5 human embryos (28 to 52 days developmental age). Histochemical observations showed the presence of a high alkaline phosphatase active in the germ cell membrane that suggested that these cells were in a state of *active* metabolic interchange with their surrounding tissue at these stages of development.

Spratt,[28] in 1954, stated: "It has long been recognized by embryologists that mature eggs are morphological and physiological systems, possessing certain differentiations which are correlated with corresponding differentiation of the adult." He further states: "If we could run the course of normal development backward, we would find that every part, organ or tissue, of the adult is represented by some particular component or group of components of the original egg organization."

In 1959, Wells and Kaiser[29] reported on 2 choice human embryos which were obtained by hysterectomy. One embryo had an ovulation age of 23 days, the other, an ovulation age of 29 ± 1 days. One interesting statement is made in their report. They state that the embryos were fixed *"while still alive..."* (italics mine) by opening the chorionic sac under 10% formalin.

In 1962, Oppenheimer stated:[30] "If anything is assumed by developmental biologists, it is that the cell is not only the structural and functional unit of the organism, but its developmental unit as well." The author's abstract of the article contains certain assumptions about embryos: (a) that

multicellular organisms are produced by eggs; (b) that development is epigenetic in so far as one step in development is a necessary condition for the next; (c) that the cell is the developmental unit of the organism; (d) that the molecule is the developmental agent of the cell.

Lash[31] perhaps best described the situation in 1964 when he stated: "It is commonly recognized that the character of normality is statistical. Considering the complexities involved at all levels of development, it is no surprise that some morphological or chemical process may stray from the acceptable or functional norm.

Embryologists frequently restate the commonly acknowledged view that during development these are manifold and *continuous* (italics mine) 'inductive' events.

"When structures develop abnormally during a course of apparent normal gestation, it is difficult to conceive of an effective control."

In the embryologists attempt to deduct and prove the development of human embryo, he has had to depend on the fact that the start of human life begins with the union of the sperm and ovum, followed by a growth and development that follows a sequential pattern that is constant. If we accept the premise that such growth is constant, then we must agree that there is no one particular moment in the develpment of an embryo when it changes from a non-living, non-human substance into a living human being.

Arey[8] has represented the life span of man as:

PRENATAL LIFE:

Ovum: Fertilization to the end of first week.

Embryo: Second to eighth week inclusive.

Fetus: Third to tenth month inclusive.

BIRTH

NEWBORN:

Neonatal period: birth to end of second week.

INFANCY:

Third week until assumption of erect posture at end of first year.

CHILDHOOD:

Early: Milk tooth period: second to sixth year inclusive.

Middle: Permanent tooth period: seven to nine or ten years inclusive.

Later: Prepubertal period: from nine or ten years to twelve to fifteen years in females and thirteen to sixteen years in males.

PUBERTY

ADOLESCENCE:

The six years following puberty.

ADULT:

Prime and Transition: Between twenty and sixty years.

Old Age and Senescence: From sixty years on.

DEATH

TWINS

The phenomenon of twinning is, as yet, an obscure process. Gedda[32] has dealt with it in his book *Twins in History and Science* and refers to Darlington's theory that meiosis represents the succession of 2 divisions of a nucleus accompanied by only one division of the chromosomes. Because of this halving process in the reproductive cells in meiosis, the number of chromosomes remains constant in each species.

Most of the data is derived from animal experimentation (particularly the armadillo) and from investigation of malformation of human embryos. Apparently a phenomenon called polyembryony occurs, in which 2 or more embryos are derived from a single fertilized ovum or zygote.

Experiments with fertilized eggs of various echinoderm led Driesch to formulate an important theory: The first 2 blastomeres can be considered as *equally and totally potent,* and therefore, capable of producing a complete organism. Later experiments on the echinoderm extended the theory to the stage of 4 blastomeres.

Experimental studies further confirmed that more than one individual may develop from a single egg and that the period when one-egg twinning occurs ranges from shortly after impregnation until the beginning of gastrulation.

There are very few twin embryos in man that are available for study. Streeter's ovum, described in 1919, is dated at the end of the 2nd week of conception, which would seem to support the theory that the 2 embryos separate long before the appearance of the primitive streak.

At no time in his discussion of twins has Gedda stated that twins are not living, human beings. He does mention the academic notion regarding one-egg twinning that is a moot philosophical idea: Since monozygotic twins are derived from a single zygote which later divides into 2 identical ones, would it not be correct to say that the single zygote represents the son, while the twins derived from its division technically are the sons of the son or the grandchildren of what apparently is the mother, but actually is the grandmother? As he says, it should serve to remind us that in science, too, the ancient proverb "Summum ius, summa inuria" applies.

It will be seen from the above that there is no sudden abrupt change from non-human to human; from non-living to living. The process is gradual but constant. A human being is formed; a human being develops; a human being is born; a human being grows; a human being dies.

To be sure, the fetus in utero is a silent human. There is no outcry; there is no protest.

The New Jersey Supreme Court stated in the recent case of Gleitman V. Cosgrove (227 azd 689 N. J.): "The right to life is inalienable in our society." It further added, concerning the birth of a defective child: "Those alleged detriments cannot stand against the preciousness of the single human life so as to support a suit for damages."

At the recent International Conference on Abortion held in Washington, D.C., September 6-8, 1967, Robert E. Cooke, M.D., Professor of Pediatrics at Johns Hopkins University School of Medicine, presented several questions that he felt might be considered before abortion laws can be enacted. Some of the questions raised were:

1. How does fetuscide really differ from infanticide? Ethically, how

do they differ? Legally, how do they differ?

2. If fetuscide is carried out for prevention of defect, would not infanticide be a logical and preferable consequence?

3. How far from normal must a fetus be, potentially to warrant fetuscide? Can normal standards with acceptable deviations be authorized? By whom?

4. Legally, who will be responsible if an attempted abortion fails and the child is handicapped?

5. Legally, will the physician be liable if abortion is performed to prevent a defect and the child is shown to be normal?

6. Legally, who will be responsible when a handicapped child is born after a potential diagnosis of normality is made?

These are all searching questions – legally, and perhaps morally. However, as doctors, we also must answer our own conscience. If we accept the findings of embryologists, we must admit that a human is developed as a gradual, vital process that begins with the union of the sperm and the ovum. Once the process has begun, we have a new human being entitled to his full legal rights under our constitution. Let us not play gods, deciding who will live or die, safe in our sanctuary of statistics and yielding to the pressures of a few.

SUMMARY AND CONCLUSIONS

1. A review of the literature on human embryology has been presented.

2. The embryo from the moment of conception shows the characteristics of a living human being: organization, growth, and metabolism.

3. If these characteristics are present in the earliest studied embryos, then the embryo must be considered as a living, human being, and as such entitled to the most important right and privilege of all human beings: Freedom to live.

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