

Human Development Before Birth

What is the unborn...biologically?

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DEFINITIONS

- Chromosomes: the vehicles used to transmit genetic information from parent to child
- DNA: the material used to encode information in chromosomes
- Mitosis (mitotic): the division of a diploid cell into two daughter cells (both diploid)
- Diploid and Haploid cells: In humans, diploid cells have 46 chromosomes and account for every cell in the body except the haploid germ cells (sex cells) which have 23 chromosomes and are made to combine with another haploid germ cell during reproduction.
- Sperm and Oocyte: Male and female sex cells, respectively.
- Zygote: the first stage of a human organism (just after the sperm enters the ovum).
- Embryo and Fetus: Generally, the embryo is the unborn human organism up until 9 weeks post-fertilization age. Beginning with the 9th week, the unborn human is called a fetus.
- Endometrium: the inner lining of the uterus that enables an embryo to implant and find nourishment throughout the pregnancy.
- Fallopian Tube: the tube leading from the ovary (where an oocyte is released) to the uterus (where an embryo implants). This is the site of fertilization, if it occurs, and is an organ specially designed to move the embryo into the uterus.

MILESTONES

Fertilization-Conception: The Beginning of the Human Organism

“Although life is a continuous process, fertilization ... is a critical landmark because, under ordinary circumstances, a new, genetically distinct human organism is formed when the chromosomes of the male and female pronuclei blend in the oocyte.” (O’Rahilly, 8)

Fertilization is a process through which a new human organism comes into being. The sperm penetrates the ovum. The sperm loses its tail and its head swells. The pronuclei of sperm and ovum (which contain 23 chromosomes each) replicate and the DNA strands align. O’Rahilly and Müller place the beginning of the life of a new organism here (O’Rahilly, 8; see also the description of fertilization on page 31). The first mitotic division takes place as the DNA strands mingle, forming a two-celled zygote (the first mitotic division into two diploid cells). The human individual at this stage has at least two key characteristics:

- Unique DNA Fingerprint: From this point on, each cell of the developing human has a unique, complete genome of 46 chromosomes (unless there is a chromosomal anomaly like Down syndrome, in which the child has 47 chromosomes).
- Whole Human Organism: Although the human individual at fertilization-conception is microscopic, she needs only a proper environment and adequate nutrition **to develop herself as an individual member of the species**. Note that this is all that is required for infants, toddlers, adolescents, and adults to develop themselves as well. In other words, there is no substantial change in the human organism from conception until natural death. It is an organism whose development is being driven from within. It is developing itself to the next stage of the organism according to the nature of the organism.

Embryonic Period (from Fertilization to 8 Weeks Post-Fertilization)

Week 1-2: Differentiation is a Slow Process

- The body is composed of stem cells (embryoblast) and an outer covering (trophoblast)
- Mom's body releases an immunological response but soon realizes the child belongs

Week 1: Traveling to Implantation in the Uterus

It takes the developing human being (sometimes called a morula and blastocyst as it develops in this period; the term *embryo* is used to denote all of the first eight weeks) about 6 days to travel from the fallopian tube (the site of fertilization) to the uterus. The endometrium (lining of the uterus) is built up to coincide with arrival of the developing human being (called an *embryo* at this stage). If the endometrium is not built up (whether by natural causes or hormonal contraceptives), the embryo will probably fail to implant, resulting in a miscarriage (the woman may not even realize she has conceived or miscarried).

Week 2: Twinning and Recombination Possible

During the first week and second week of development, the human being can reproduce asexually by dividing itself into two human beings (twinning). Some scientists believe that when this happens the twins can also recombine into one human individual.

Weeks 3-8: Heart and Brain Begin to Function

- Heart begins to beat at about 21 days (end of week 3): "By the end of the third week, the blood is circulating, and the heart begins to beat on day 21 or 22..." (Moore, 56)
- Primitive heart muscle begins pulsations at the beginning of week 4
- A regular heartbeat becomes established at the beginning of week 5
- Heart is partitioned into four chambers at eight weeks gestation. (Moore 273)
- Brain begins functioning at about 6 weeks: "Synaptic function is sufficiently developed by the eighth week of gestation [6 weeks post-fertilization-ed.] to demonstrate flexion of neck and trunk." (Williams, 182)
- By the end of the embryonic period (end of week 8), the foundation of all the major anatomical systems have been laid down; growth and refinement of these systems occur thereafter until birth (the fetal period).

Fetal Period (from 9 Weeks Post-Fertilization to Birth)

- The fetus is called a "well-proportioned small-scale baby" by the Amicus Curiae (Friend of the Court) brief to the court that decided *Roe v. Wade*. Development is all that takes place from this point on.
- Fingers (53 days) and toes (55 days) are no longer webbed (Moore, 68)

Newborn Period (After Birth)

Note: It's legal in the United States to kill the unborn until birth. While it's illegal to directly kill newborns, disabled newborns are sometimes starved to death. In addition, philosophers like Peter Singer argue that newborns have no intrinsic value and that killing them would not be wrong.

- Neural connections in the brain increase significantly after birth.
- Self-awareness (the ability to see oneself existing over time) is only gained months after birth. Some philosophers see this ability as essential to moral standing. So, if self-awareness is the thing that gives us value, then it's not only unborn children who can be harmed, but also children who are already born.

FURTHER STUDY

- Photographs of the Embryo at Each Stage of Embryonic Development: <http://embryology.med.unsw.edu.au>
- Good Summary of Fetal Development: http://abort73.com/abortion/prenatal_development
- Video and Photographs of the Embryo at Various Stages: www.ehd.org, www.ehd.org/science_imagegal_3.php#MRI

SOURCES

- (O'Rahilly): O'Rahilly, Ronan and Müller, Fabiola, *Human Embryology and Teratology*, 3rd ed. (New York: Wiley-Liss, 2001)
- (Moore): Keith Moore and T.V.N. Persaud, *Before We Are Born: Essentials of Embryology and Birth Defects*, 6th ed. (Philadelphia: Saunders, 2003)
- (Williams): Cunningham, F.G., et. al., *Williams Obstetrics*, 19th ed. (Norwalk, CT: Appleton & Lange, 1993)