

CONTENTS

1. Introduction	1
2. Historic Embryology	2 - 3
3. First Trimester	4 - 5
➤ From week 1 to 4	
➤ From week 5 to 8	
➤ From week 9 to 12	
➤ Week 13	
4. Second Trimester.	6 - 7
➤ From week 14 to 17	
➤ From week 18 to 21	
➤ From week 22 to 25	
➤ From week 26 to 27	
5. Third Trimester.	8 - 9
➤ From week 28 to 30	
➤ From week 31 to 34	
➤ From week 35 to 38	
➤ From week 39 to 42	
6. Some Recent Finding.	10

INTRODUCTION

Human development is one of the most exciting topics to study not only as a medical student, but also for our fundamental understanding of the human body. Of all health issues in Medicine, fertility and reproduction is a topic that will affect everyone. Now a days, the interest in human development is widespread largely because of curiosity about our beginnings and a desire to improve the quality of human life. The process by which a baby develops from a single cell is miraculous and few events are more exciting than a human birth.

Human development is a continuous process that begins when an ovum is fertilized by a sperm. Cell division, growth, differentiation, and even cell death, transform the fertilized ovum into a multicellular human being. Although important maturational changes continue to occur during the postnatal period (infancy, childhood, adolescence and even adulthood), the formation of the organ systems occurs between fertilization and birth, the prenatal period. The four initial stages of development are the morula stage, the blastula stage, the gastrula stage and the neurula stage.

An embryo is an early stage of development of a multicellular diploid eukaryotic organism. In general in organisms that reproduce sexually, an embryo develops from a zygote, the single cell resulting from the fertilization of the female egg cell by the male sperm cell. Embryogenesis is the process by which the embryo forms and develops. In mammals, the term refers chiefly to early stages of prenatal development, whereas the term fetus and fetal development describe later stages.

Embryogenesis starts with the fertilization of the egg cell (ovum) by a sperm cell, (spermatozoon).

HISTORIC EMBRYOLOGY

- Around 1400 BC Egyptians made reference to the placenta and its importance as the seat of the external soul.
- Hippocrates and Aristotle are recognized as the first true embryologists.
- Hippocrates (460 BC–370 BC) believed that the embryo began development by extracting moisture and breath from the mother and he identified a series of condensations and fires that were responsible for the development of bones, belly, and circulation in the embryo and fetus. He also supported the view that the human fetus gained nourishment by sucking blood from the placenta.
- Aristotle (384 BC–322 BC) studied embryos of different organisms by opening up bird eggs at different stages of development and dissecting mammalian and cold-blooded embryos. He observed that young embryos of different species all possessed universal characteristics and that as the embryos aged, differentiating characteristics arose.
- Galen's (150 AD to 180 AD) main contribution to embryology was his steadfast belief that the umbilical cord was necessary for respiration.
- Albertus Magnus reawakened scientific embryology. Albert believed that women had seeds and that seeds coagulated, much like cheese, after coming in contact with male seeds. When a coagulated seed made contact with menstrual blood, the seed now had the nutrition necessary for proper development.

- Leonardo da Vinci was the first to provide evidence that embryos can be measured chronologically and that they change in weight, size, and shape over time. He is credited for his dissection of the human fetus and his quantitative measurements of embryonic growth.
- William Harvey (1578 AD–1667 AD) determined the position where the embryo arises in an egg, the so-called white spot, and described the blastoderm as the unique place of origin of the embryonic body. He also wrote of the importance of the amniotic fluid, believing that it was absorbed into the blood of the embryo and later, the fetus.
- Marcello Malpighi (1628 AD–1694 AD) described embryo development as a simple unfolding of an already miniature adult organism.
- Nicholas Stensen in 17th century demonstrated that the human female ovary was homologous to the ovaries in previously studied oviparous animals.
- The mammalian egg was finally seen and recognized as a single cell; the idea of the recapitulation theory began to take shape
- Scottish surgeon John Hunter showed that the maternal and fetal circulations were distinct physiologies.
- Karl Ernst von Baer and Heinz Christian pander proposed the germ layer theory of development; von Baer discovered the mammalian ovum, in 1827.
- The span of gestation and the cause of the birth were discovered by Jena, Gustav Fischer in 1897.

FIRST TRIMESTER

➤ From week 1 to 4

The weeks of pregnancy are dated from the first day of the last period. This means that in the first two weeks the body will be preparing for the ovulation as usual. Amazingly, during the third week the child's sex and all of its inherited genetic characteristics. The developing baby now called a zygote. After fertilization, the ball of cells, now an embryo, the embryo burrows into the lining of the womb (Implantation). During the fourth week the embryo splits into two parts. One half will become the placenta. In the other half, the embryo itself continues to grow, and a sheet of cells has just begun to create the neural tube, where the baby's brain, spinal cord and backbone will ultimately form.

➤ From week 5 to 8

During the fifth week, the embryo ticker will start beating for the first time. The embryo now has three distinct layers: the ectoderm, the endoderm, and the mesoderm. Starting from the sixth week until birth, the embryo heart will beat about 150 times a minute. And in the 6th week the brain hemispheres are forming and brain waves can now be recorded. During the 7th week the embryo develops distinct facial features. The nerve cells in the baby's brain

are growing at an amazing rate -- 100,000 cells per minute. At 8 weeks, the fetus is about one-half an inch long (1.1cm). Facial features such as developing ears, eyelids, and nose tip are present.

➤ From week 9 to 12

During the 9th week the reproductive organs are beginning to form, along with some other key organs, like the pancreas and gallbladder. Until 10th week the baby was classified as an embryo, but by the end of the 10th week the baby will be classified as fetus. Paddle-like, or webbed, hands and feet will now separate into fingers and toes, bones will begin to harden and his kidneys are now producing urine. From the 10th and 11th weeks the fetus will start to inhale and exhale small amounts of amniotic fluid. At 12 weeks, the fetus has grown to about 2 inches (4.4cm) in length and may begin to move by itself. The fingers and toes are discernible and the fetal heartbeat may be audible by Doppler ultrasound.

➤ Week 13

During this week the fetus arms will lengthen to be proportionate with his body, and the fetus will be able to stick thumb in the mouth. Also by now, all of the essential organs and systems have formed.

SECOND TRIMESTER

➤ From week 14 to 17

In 14th week if the fetus is a boy, the prostate is forming, and if the fetus is a girl, her ovaries are moving down into her pelvis. In 15th week the Lanugo will be formed which is the first ultrafine, downy hair, now covers his back, shoulders, ears, and forehead. It helps fetus retain body heat, but once he gains enough fat to do the job, this hair will fall off. In the 16th week the fetus's delicate skeleton continues to harden from rubbery cartilage to bone. The umbilical cord has fully matured. In the 17th week the fetus starts plumping up this week, as body fat is deposited under his skin and sweat glands develop.

➤ From week 18 to 21

In the 18th week the bones and nerves in ears are developed enough to function, the fetus can hear all sorts of sounds including blood coursing through the umbilical cord and the mother's heartbeat. In the 19th week Vernix caseosa begins to coat the skin. This coating helps regulate body temperature and protects from the amniotic fluid. At 20th weeks the developing baby is about 6 inches long and may weigh about 10 ounces. The

baby may begin to make movements that the mother can feel at about 19 to 21 weeks; this baby movement is termed "quickenings".

➤ From week 22 to 25

During 22nd week the baby's skin becomes opaque but will remain wrinkly, red, and covered in vernix. Also this week, the baby's fine-tuning his sense of touch. Billions of brain cells will develop and control the baby's movements and life functions. Surfactant is being produced, a substance that enables the air sacs to inflate and the lungs to fully expand. At 24 weeks, the baby may weigh 1.4 pounds. The baby's inner ear canals are developed at 24 weeks, so researchers speculate the baby can sense its position in the uterus. During the 25th week the baby's first bowel movement will form in the large intestine. The thick, dark poop is called meconium and it's typically excreted shortly after the baby born.

➤ From week 26 to 27

The baby settles into a distinct sleep-wake pattern. And the baby has been hiccupping every once in a while for several weeks, and the parent might actually feel these baby hiccups, which are triggered by the involuntary movements of the baby's diaphragm. But as the baby's trachea is filled with fluid instead of air, fetal hiccups don't make a sound.

THIRD TRIMESTER

➤ From week 28 to 30

Until now, the baby's eyelids have been fused shut, but in 28th week the baby will begin to open and close the eyes. And the irises are now filled with pigment. At 28 weeks, the baby normally weighs about 2 and one-half pounds and has developed to the point that if the baby is birthed prematurely for any reason, the chances are good that the infant will survive. From week 30 the baby will gain about a half pound each week. Now that all of the major body systems are in place and functioning , and needs padding to protect and insulate the baby's organs.

➤ From week 31 to 34

In the week 31 there is a development in the reproductive organs. If the fetus is a male then the testicles will descend into the scrotum through the inguinal canal. If the fetus is female then the clitoris will be formed. By 32 weeks all the major organs are fully functioning except the lungs, which need just a bit more time to mature completely. In the week 34 the protective vernix caseosa begins to thicken. The bones in baby's skull aren't fused yet. That

allows them to shift as his head squeezes through the birth canal. They won't fully fuse until adulthood.

➤ From week 35 to 38

Now, the unborn baby should be positioning the head facing down towards cervix and vagina. And the baby tries to accumulate all the fat which helps the baby to maintain the body temperature and store energy. In the week 37 the umbilical cord begins passing to the baby in preparation for delivery. The baby's hearing, eyesight is improving each day. His fingers are also becoming more coordinated.

➤ From week 39 to 42

By now the baby has likely reached the birth weight (6-9 pounds) and length (18-22 inches). At 39 weeks, the baby will be considered full-term infant. The placenta continues to supply the baby with nutrients and antibodies until the parturition .

SOME RECENT FINDINGS

- Stresses and strains on the human fetal skeleton during embryonic development:-“Mechanical forces generated by fetal kicks and movements result in the stimulation of the fetal skeleton in the form of stress and strain”.
- Size and location of the kidneys during the fetal period:- “The level of the left kidney was higher than the level of the right kidney in the fetal period. The posterior surface relations to the ribs showed certain ascendance during gestation, corresponding to the vertebral levels.
- The offspring of the women with obesity during their pregnancy are exposed to an altered intra-uterine environment. A subsequent influence on the cardiovascular development during fetal life is assumed.
- Estetrol (E4) is a natural estrogen synthesized during pregnancy by the human fetal liver, and the physiological role of this hormone is unknown. Biologists have aforementioned that E4 has anti-thrombotic properties.

CONCLUSION

Embryonic development has fascinated scientists and philosophers from ancient culture to the present day. This project explores embryonic development. It is very amazing and interesting to learn about the human development and how our bodies came into being. Where development describes the growth of humans throughout the lifespan, from conception to death.

This project has helped to know the logical basis for understanding the overall organization of the human body. It has become increasingly clear that the key features of embryonic development have remained for the most part unaltered through evolution. While animals show obvious differences in appearance, the majority of their genes are well preserved, demonstrating roughly similar structure and function.

However, despite years of dedicated research, much still remains to be discovered on the formation of gametes (the sex cells), fertilization, and the subsequent development of the embryo.

BIBLIOGRAPHY

Websites:-

- www.google.co.in
- <https://embryo.asu.edu/pages/history-embryology-1959-joseph-needham>
- https://embryology.med.unsw.edu.au/embryology/index.php/fetal_development
- <https://www.parents.com/pregnancy/week-by-week/baby-development/>
- https://www.onhealth.com/content/1/fetal_development_stages
- www.sciencedirect.com

