Prenatal development

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This article is about prenatal development of human embryos and fetuses. For other species, see prenatal development (non-human). For maternal changes in the prenatal period, see Maternal physiological changes in pregnancy.

Prenatal or antenatal development is the process in which a human embryo or fetus (or foetus) gestates during pregnancy, from fertilization until birth. Often, the terms fetal development, foetal development, or embryology are used in a similar sense.

After fertilization the embryogenesis starts. In humans, when embryogenesis finishes, by the end of the 10th week of gestational age, the precursors of all the major organs of the body have been created. Therefore, the following period, the fetal period, is described both topically on one hand, i.e. by organ, and strictly chronologically on the other, by a list of major occurrences by weeks of gestational age.

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Definitions of periods[edit]

Stages during pregnancy. Embryogenesis is marked in green. Weeks and months are numbered by gestation.

The perinatal period (from Greek peri, "about, around" and Latin nasci "to be born") is "around the time of birth". In developed countries of the world and at facilities where expert neonatal care is available, it is considered from 22 completed weeks (154 days) of gestation (the time when birth weight is normally 500 g) to 7 completed days after birth.[1] In many developing countries, the starting point of this period is considered 28 completed weeks of

gestation (or weight more than 1000 g).[2] In ICD-10, a medical classification list by the WHO, there is a particular chapter relating to certain conditions originating in the perinatal period.

The antepartum period (from Latin ante "before" and parere "to give birth") is literally equivalent to prenatal (from Latin pre- "before" and nasci "to be born"). Practically, however, antepartum usually refers to the period between the 24th/26th week of gestational age until birth, for example in antepartum hemorrhage.[3][4]

Fertilization[edit]Main article: Human fertilization

A sperm fertilizing an ovum.When semen is deposited in the vagina, the spermatozoa travel through the cervix and body of the uterus and into the Fallopian tubes. Fertilization of the ovum (egg cell) usually takes place in the Fallopian tube. Many sperm must cooperate to penetrate the thick protective shell-like barrier that surrounds the ovum. The first sperm that penetrates fully into the egg donates its genetic material (DNA). The egg then polarizes, repelling any additional sperm. The resulting combination is called a zygote, a new and genetically unique human organism. The term "conception" refers variably to either fertilization or to formation of the conceptus after uterine implantation, and this terminology is controversial.

Prior to fertilization, each ovum contains a complete human genome, including a single X but no Y chromosome. Likewise, each spermatozoon contains a complete set of autosomes and a

single sex chromosome, either X or Y. The resulting human zygote is similar to the majority of somatic cells because it contains two copies of the genome in a diploid set of chromosomes. One set of chromosomes came from the nucleus of the ovum and the second set from the nucleus of the sperm.

The zygote is male if the egg is fertilized by a sperm that carries a Y chromosome, and it is female if the egg is fertilized by a sperm that carries an X chromosome.[5] Unlike the X chromosome, the Y chromosome contains very little genetic information. However it does contain a gene, SRY, which will switch on androgen production at a later stage, leading to the development of a male body type. In contrast, the mitochondrial genetic information of the zygote comes entirely from the mother via the ovum.

Embryonic period[edit]Main article: Human embryogenesis

The initial stages of human embryogenesis.The embryonic period in humans begins at fertilization (penetration of the egg by the sperm) and continues until the end of the 10th week of gestation (8th week by embryonic age).

The embryo spends the next few days traveling down the Fallopian tube. It starts out as a single cell zygote and then divides several times to form a ball of cells called a morula. Further cellular division is accompanied by the formation of a

small cavity between the cells. This stage is called a blastocyst. Up to this point there is no growth in the overall size of the embryo, as it is confined within a glycoprotein shell, known as the zona pellucida. Instead, each division produces successively smaller cells.

The blastocyst reaches the uterus at roughly the fifth day after fertilization. It is here that lysis of the zona pellucida occurs. This process is analogous to zona hatching, a term that refers to the emergence of the blastocyst from the zona pellucida, when incubated in vitro. This allows the trophectoderm cells of the blastocyst to come into contact with, and adhere to, the endometrial cells of the uterus. The trophectoderm will eventually give rise to extra-embryonic structures, such as the placenta and the membranes. The embryo becomes embedded in the endometrium in a process called implantation. In most successful pregnancies, the embryo implants 8 to 10 days after ovulation (Wilcox et al. 1999). The embryo, the extra-embryonic membranes, and the placenta are collectively referred to as a conceptus, or the "products of conception".

Rapid growth occurs and the embryo's main external features begin to take form. This process is called differentiation, which produces the varied cell types (such as blood cells, kidney cells, and nerve cells). A spontaneous abortion, or miscarriage, in the first trimester of pregnancy is usually[6] due to major genetic mistakes or abnormalities in the developing embryo. During this

critical period (most of the first trimester), the developing embryo is also susceptible to toxic exposures, such as:

Alcohol, certain drugs, and other toxins that cause birth defects, such as Fetal alcohol syndrome

Infection (such as rubella or cytomegalovirus)

Radiation from x-rays or radiation therapy

Nutritional deficiencies such as lack of folate which contributes to spina bifida

Generally, if a structure pre-dates another structure in evolutionary terms, then it often appears earlier than the other in an embryo; this general observation is sometimes summarized by the phrase "ontogeny recapitulates phylogeny."[7] For example, the backbone is a common structure among all vertebrates such as fish, reptiles and mammals, and the backbone also appears as one of the earliest structures laid out in all vertebrate embryos. The cerebrum in humans, which is the most sophisticated part of the brain, develops last. The concept of recapitulation is not absolute, but it is recognized as being partly applicable to development of the human embryo.[7]

Changes by weeks of gestation[edit]See also: Embryo and Human embryogenesis

Gestational age vs. embryonic age[edit]Gestational age is the time that has passed since the onset of the last menstruation, which generally or as standard occurs 2 weeks before the actual

fertilization. Embryonic age, in contrast measures the actual age of the embryo or fetus from the time of fertilization. Nevertheless, menstruation has historically been the only means of estimating embryonal/fetal age, and is still the presumed measure if not else specified. However, the actual duration between last menstruation and fertilization may in fact differ from the standard 2 weeks by several days.

Thus, the first week of embryonic age is already week three counting with gestational age.

Furthermore, the number of the week is one more than the actual age of the embryo/fetus. For example, the embryo is 0 whole weeks old during the 1st week after fertilization.

The following table summarizes the various expression systems during week number x of gestation.

Week number Reached age (whole weeks)	
Gestational	x x-1
Embryonic	x-2 x-3

Week 1–2[edit]Week 1–2 of gestational age are theoretical extrapolations of embryonic age, since the fertilization hasn't actually occurred yet.

Gestational age: 0 weeks and 0 days until to 1 week and 6 days old. 1–14 days from last menstruation.

Embryonic age: -2 to -1 weeks old.

Week 3[edit]Gestational age: 2 weeks and 0 days until 2 weeks and 6 days old. 15–21 days from last menstruation.

Embryonic age: Week nr 1. 0 (whole) weeks old. 1–7 days from fertilization.

Fertilization of the ovum to form a new human organism, the human zygote. (day 1 of fert.[8])

The zygote undergoes mitotic cellular divisions, but does not increase in size. This mitosis is also known as cleavage. A hollow cavity forms marking the blastocyst stage. (day 1.5–3 of fert.[8])

The blastocyst contains only a thin rim of trophoblast cells and a clump of cells at one end known as the "embryonic pole" which include embryonic stem cells.

The embryo hatches from its protein shell (zona pellucida) and performs implantation onto the endometrial lining of the mother's uterus. (day 5–6 of fert.[8])

If separation into identical twins occurs, 1/3 of the time it will happen before day 5.[9]

Week 4[edit]Gestational age: 3 weeks and 0 days until 3 weeks and 6 days old. 22–28 days from last menstruation.

Embryonic age: Week nr 2. 1 week old. 8–14 days from fertilization.

Trophoblast cells surrounding the embryonic cells proliferate and invade deeper into the uterine lining. They will eventually form the placenta and embryonic membranes. The blastocyst is fully implanted day 7–12 of fert.[8]

Formation of the yolk sac.

The embryonic cells flatten into a disk, two cells thick.

If separation into identical twins occurs, 2/3 of the time it will happen between days 5 and 9. If it happens after day 9, there is a significant risk of the twins being conjoined.

Primitive streak develops. (day 13 of fert.[8])

Primary stem villi appear. (day 13 of fert.[8])

Week 5[edit]Gestational age: 4 weeks and 0 days until 4 weeks and 6 days old. 29–35 days from last menstruation.

Embryonic age: Week nr 3. 2 weeks old. 15–21 days from fertilization.

A notochord forms in the center of the embryonic disk. (day 16 of fert.[8])

Gastrulation commences. (day 16 of fert.[8])

A neural groove (future spinal cord) forms over the notochord with a brain bulge at one end. Neuromeres appear. (day 18 of fert.[8])

Somites, the divisions of the future vertebra, form. (day 20 of fert.[8])

Primitive heart tube is forming. Vasculature begins to develop in embryonic disc. (day 20 of fert.[8])

Embryo at 6 weeks after fertilization. The crown-rump length is about 0.2 inches.[10]

A 10mm embryo from an ectopic pregnancy, still in the oviduct. This embryo is about five weeks old (or from the seventh week of menstrual age).Week 6[edit]Gestational age: 5 weeks and 0 days until 5 weeks and 6 days old. 36–42 days from last menstruation.

Embryonic age: Week nr 4. 3 weeks old. 22–28 days from fertilization..

The embryo measures 4 mm (1/8 inch) in length and begins to curve into a C shape.

The heart bulges, further develops, and begins to beat in a regular rhythm. Septum primum appears.[8]

Branchial arches, grooves which will form structures of the face and neck, form.

The neural tube closes.

The ears begin to form as otic pits.

Arm buds and a tail are visible.

Pulmonary primordium, the first traits of the lung appear.[8]

Hepatic plate, the first traits of the liver appear.[8]

Buccopharyngeal membrane ruptures. This is the future mouth.[8]

Cystic diverticulum, which will become the gallbladder, and dorsal pancreatic bud, which will become the pancreas appear.[8]

Urorectal septum begins to form. Thus, the rectal and urinary passageways become separated.[8]

Anterior and posterior horns differentiate in the spinal cord [8]

Spleen appears.[8]

Ureteric buds appear.[8]

This embryo is also from an ectopic pregnancy, this one in the cornu (the part of the uterus to which the Fallopian tube is

attached). The features are consistent with a developmental age of seven weeks (reckoned as the ninth week of pregnancy).Week 7[edit]Gestational age: 6 weeks and 0 days until 6 weeks and 6 days old. 43–49 days from last menstruation.

Embryonic age: Week nr 5. 4 weeks old. 29–35 days from fertilization.

The embryo measures 9 mm (1/4 inch) in length.

Lens pits and optic cups form the start of the developing eye.

Nasal pits form.

The brain divides into 5 vesicles, including the early telencephalon.

Leg buds form and hands form as flat paddles on the arms.

Rudimentary blood moves through primitive vessels connecting to the yolk sac and chorionic membranes.

The metanephros, precursor of the definitive kidney, starts to develop.

The initial stomach differentiation begins.

[11]

Week 8[edit]Gestational age: 7 weeks and 0 days until 7 weeks and 6 days old. 50–56 days from last menstruation.

Embryonic age: Week nr 6. 5 weeks old. 36–42 days from fertilization.

The embryo measures 13 mm (1/2 inch) in length.

Lungs begin to form.

The brain continues to develop.

Arms and legs have lengthened with foot and hand areas distinguishable.

The hands and feet have digits, but may still be webbed.

The gonadal ridge begins to be perceptible.

The lymphatic system begins to develop.

Main development of external genitalia starts.

Week 9[edit]

A six-week embryonic age or eight-week gestational age intact human embryo.Gestational age: 8 weeks and 0 days until 8 weeks and 6 days old. 57–63 days from last menstruation.

Embryonic age: Week nr 7. 6 weeks old. 43–49 days from fertilization.

The embryo measures 18 mm (3/4 inch) in length.

Fetal heart tone (the sound of the heart beat) can be heard using doppler.

Nipples and hair follicles begin to form.

Location of the elbows and toes are visible.

Spontaneous limb movements may be detected by ultrasound.

All essential organs have at least begun.

The vitelline duct normally closes.

Fetal period[edit]From the 10th week of gestation (8th week of development), the developing organism is called a fetus.

All major structures are already formed in the fetus, but they continue to grow and develop.

Since the precursors of all the major organs are created by this time, the fetal period is described both by organ and by a list of changes by weeks of gestational age.

Because the precursors of the organs are now formed, the fetus is not as sensitive to damage from environmental exposure as the embryo was. Instead, toxic exposure often causes physiological abnormalities or minor congenital malformation.

Changes by organ[edit]Each organ has its own development.

Development of circulatory system

Heart development

Development of digestive system

Tooth development

Development of endocrine system

Development of integumentary system

Development of lymphatic system

Development of muscular system

Development of nervous system

Development of the urinary and reproductive system

Development of the reproductive system

Development of the gonads

Development of respiratory system

Changes by weeks of gestation[edit]

Fetus at 8 weeks after fertilization.[12]Weeks 10–12[edit]Gestational age: 9 weeks and 0 days until 11 weeks and 6 days old.

Embryonic age: Weeks nr 8–10. 7–9 weeks old.

Embryo measures 30–80 mm (1.2–3.2 inches) in length.

Ventral and dorsal pancreatic buds fuse during the 8th week

Intestines rotate.

Facial features continue to develop.

The eyelids are more developed.

The external features of the ear begin to take their final shape.

The head comprises nearly half of the fetus' size.

The face is well formed

The eyelids close and will not reopen until about the 28th week.

Tooth buds, which will form the baby teeth, appear.

The limbs are long and thin.

The fetus can make a fist with its fingers.

Genitals appear well differentiated.

Red blood cells are produced in the liver.

Weeks 13 to 16[edit]Gestational age: 12 weeks and 0 days until 15 weeks and 6 days old.

Embryonic age: Weeks nr 11–14. 10–13 weeks old.

The fetus reaches a length of about 15 cm (6 inches).

A fine hair called lanugo develops on the head.

Fetal skin is almost transparent.

More muscle tissue and bones have developed, and the bones become harder.

The fetus makes active movements.

Sucking motions are made with the mouth.

Meconium is made in the intestinal tract.

The liver and pancreas produce fluid secretions.

From week 13, sex prediction by obstetric ultrasonography is almost 100% accurate.[13]

At week 15, main development of external genitalia is finished

Fetus at 18 weeks after fertilization.[14]Week 19[edit]Gestational age: 18 weeks old.

Embryonic age: Week nr 17. 16 weeks old.

The fetus reaches a length of 20 cm (8 inches).

Lanugo covers the entire body.

Eyebrows and eyelashes appear.

Nails appear on fingers and toes.

The fetus is more active with increased muscle development.

"Quickening" usually occurs (the mother and others can feel the fetus moving).

The fetal heartbeat can be heard with a stethoscope.

Week 23[edit]Gestational age: 22 weeks old.

Embryonic age: Week nr 21. 20 weeks old.

The fetus reaches a length of 28 cm (11.2 inches).

The fetus weighs about 925g.

Eyebrows and eyelashes are well formed.

All of the eye components are developed.

The fetus has a hand and startle reflex.

Footprints and fingerprints continue forming.

Alveoli (air sacs) are forming in lungs.

Week 27[edit]Gestational age: 26 weeks old.

Embryonic age: Week nr 25. 24 weeks old.

The fetus reaches a length of 38 cm (15 inches).

The fetus weighs about 1.2 kg (2 lb 11 oz).

The brain develops rapidly.

The nervous system develops enough to control some body functions.

The eyelids open and close.

The cochleae are now developed, though the myelin sheaths in neural portion of the auditory system will continue to develop until 18 months after birth.

The respiratory system, while immature, has developed to the point where gas exchange is possible.

Week 31[edit]Gestational age: 30 weeks old.

Embryonic age: Week nr 29. 28 weeks old.

The fetus reaches a length of about 38–43 cm (15–17 inches).

The fetus weighs about 1.5 kg (3 lb 0 oz).

The amount of body fat rapidly increases.

Rhythmic breathing movements occur, but lungs are not fully mature.

Thalamic brain connections, which mediate sensory input, form.

Bones are fully developed, but are still soft and pliable.

The fetus begins storing a lot of iron, calcium and phosphorus.

Week 35[edit]Gestational age: 34 weeks old.

Embryonic age: Week nr 33. 32 weeks old.

The fetus reaches a length of about 40–48 cm (16–19 inches).

The fetus weighs about 2.5 to 3 kg (5 lb 12 oz to 6 lb 12 oz).

Lanugo begins to disappear.

Body fat increases.

Fingernails reach the end of the fingertips.

A baby born at 36 weeks has a high chance of survival, but may require medical interventions.

Fetus at 38 weeks after fertilization.[15]Weeks 36 to 40[edit]Gestational age: 35 and 0 days until 39 weeks and 6 days old.

Embryonic age: Weeks nr 34–38. 33–37 weeks old.

The fetus is considered full-term at the end of the 39th week of gestational age.

It may be 48 to 53 cm (19 to 21 inches) in length.

The lanugo is gone except on the upper arms and shoulders.

Fingernails extend beyond fingertips.

Small breast buds are present on both sexes.

Head hair is now coarse and thickest.

The development is continued postnatally with adaptation to extrauterine life and child development stages.

Nutrition[edit]The fetus passes through 3 phases of acquisition of nutrition from mother:[16]

Absorption phase: Zygote is nourished by cellular cytoplasm and secretions in fallopian tubes and uterine cavity.

Histoplasmic transfer: After nidation and before establishment of uteroplacental circulation, fetus nutrition is derived from decidual cells and maternal blood pools that open up as a result of eroding activity of trophoblasts.

Hematotrophic phase: After third week of gestation, substances are transported passively via intervillous space.

Growth rate[edit]Growth rate of fetus is linear upto 37 weeks of gestation, after which it plateaues.[16] The growth rate of an embryo and infant can be reflected as the weight per gestational age, and is often given as the weight put in relation to what would be expected by the gestational age. A baby born within the normal range of weight for that gestational age is known as appropriate for gestational age (AGA). An abnormally slow growth

rate results in the infant being small for gestational age, and, on the other hand, an abnormally large growth rate results in the infant being large for gestational age. A slow growth rate and preterm birth are the two factors that can cause a low birth weight. Low birth weight (below 2000 grams) can ultimately increase the likelihood of schizophrenia by almost four times. [17]

The growth rate can be roughly correlated with the fundal height which can be estimated by abdominal palpation. More exact measurements can be performed with obstetric ultrasonography.

Factors influencing growth rate[edit] This section does not cite any references or sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. (November 2012)

Poverty

Poverty has been linked to poor prenatal care and has been an influence on prenatal development. Women in poverty are more likely to have children at a younger age, which results in low birth weight. Many of these expecting mothers have little education and are therefore less aware of the risks of smoking, alcohol, and drugs - other factors that influence the growth rate of a fetus. Women in poverty are more likely to have diseases that are harmful to the fetus.

Mother's age

Women between the ages of 16 and 35 have a healthier environment for a fetus than women under 16 or over 35. Women between this age gap are more likely to have fewer complications. Women over 35 are more inclined to have a longer labor period, which could potentially result in death of the mother or fetus. Women under 16 and over 35 have a higher risk of preterm labor (premature baby), and this risk increases for women in poverty, African Americans, and women who smoke. Young mothers are more likely to engage in high risk behaviors, such as using alcohol, drugs, or smoking, resulting in negative consequences for the fetus. Premature babies from young mothers are more likely to have neurological defects that will influence their coping capabilities - irritability, trouble sleeping, crying, etc. There is a risk of mental retardation for infants over the age of 40 - down syndrome. Teen mothers and mother over 35 are more exposed to the risks of miscarriages, premature births, and birth defects.

Drug use

Eleven percent of fetus's are exposed to illicit drug use during pregnancy. Maternal drug use occurs when drugs ingested by the pregnant woman are metabolized in the placenta and then transmitted to the fetus. When using drugs (narcotics), there is a greater risk of birth defects, low birth weight, and a higher rate of death in infants or stillbirths. Drug use will influence extreme irritability, crying, and risk for SIDS once the fetus is born. The chemicals in drugs can cause an addiction in the babies once they are born. Marijuana will slow the fetal growth rate and can

result in premature delivery. It can also lead to low birth weight, a shortened gestational period and complications in delivery. Heroin will cause interrupted fetal development, stillbirths, and can lead to numerous birth defects. Heroin can also result in premature delivery, creates a higher risk of miscarriages, result in facial abnormalities and head size, and create gastrointestinal abnormalities in the fetus. There is an increased risk for SIDS, dysfunction in the central nervous system, and neurological dysfunctions including tremors, sleep problems, and seizures. The fetus is also put at a great risk for low birth weight and respiratory problems. Cocaine use results in a smaller brain, which results in learning disabilities for the fetus. Cocaine puts the fetus at a higher risk of being stillborn or premature. Cocaine use also results in low birthweight, damage to the central nervous system, and motor dysfunction.

Alcohol

Alcohol use leads to disruptions of the fetus's brain development, interferes with the fetus's cell development and organization, and affects the maturation of the central nervous system. Alcohol use can lead to heart and other major organ defects, such as small brain, which will affect the fetus's learning behaviors. Alcohol use during pregnancy can cause behavioral problems in a child, mental problems or retardation and facial abnormalities - meaning smaller eyes, thin upper lip, and little groove between the nose and lips. Use can also increase the risk of miscarriages and stillbirths, or low birth weight. Fetal alcohol syndrome (FAS) is a developmental disorder that is a consequence of too much alcohol intake by the mother during pregnancy. Children with FAS

have a variety of distinctive facial features, brain abnormalities, and cognitive deficits.[5]

Smoking and Nicotine

When a mother smokes during pregnancy the fetus is exposed to nicotine, tar, and carbon monoxide. Nicotine results in less blood flow to the fetus because it constricts the blood vessels. Carbon monoxide reduces the oxygen flow to the fetus. The reduction of blood and oxygen flow results in stillbirth, low birth weight, and ectopic pregnancy. There is an increase of risk of sudden death syndrome (SIDS) in infants. Nicotine also increases the risk for miscarriages and premature births or infant mortality. There has been a link from smoking during pregnancy that led to asthma in childhood. Low birth weight and premature births can also increase the risk of asthma if a mother smoked during pregnancy because of the effects on the respiratory system of the fetus.

Diseases

If a mother is infected with a disease, the placenta cannot filter out the virus carriers and infect the fetus. Babies can be born with venereal diseases transmitted by the mother.

Mother's diet and physical health

An adequate nutrition is needed for a healthy fetus. A lack of iron results in anemia in the fetus, the lack of calcium can result in

poor bone and teeth formation, and the lack of protein can lead to a smaller fetus and mental retardation.

Mother's prenatal depression

A study found that mother's prenatal depression was associated with adverse perinatal outcomes such as slower fetal growth rates. It appears that prenatal maternal cortisol levels play a role in mediating these outcomes.[18]

Environmental toxins

Toxins lead to higher rates of miscarriage, sterility, and birth defects. Toxins include fetal exposure to lead, mercury, and ethanol or hazardous environments.

Low birth weight

Low birth weight increases an infants risk of long-term growth and cognitive and language deficits. It also results in a shortened gestational period and can lead to prenatal complications.

Fetal hematology[edit]Fetal hematopoiesis first takes place in the yolk sac. The function is transferred to liver by 10th week of

gestation and to spleen and bone marrow beyond that. The total blood volume is about 125 ml/kg fetal body weight near term.

Erythrocytes[edit]Fetus produces megaloblastic red blood cells early in development, which become normoblastic near term. Life span of fetal RBCs is 80 days. Rh antigen appears at about 40 days of gestation.

Leukocytes[edit]Fetus starts producing leukocytes at 2 months gestation mainly from thymus and spleen. Lymphocytes derived from thymus are called T lymphocytes, whereas the ones derived from bone marrow are called B lymphocytes. Both these populations of lymphocytes have short-lived and long-lived groups. Short-lived T lymphocytes usually reside in thymus, bone marrow and spleen; whereas long-lived T lymphocytes reside in blood stream. Plasma cells are derived from B lymphocytes and their life in fetal blood is 0.5 to 2 days.

Fetal endocrinology[edit]Thyroid gland is the first to develop in fetus at 4th week of gestation. Insulin secretion in fetus starts around 12th week of gestation.

See also[edit]Environmental toxins and fetal development

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Fetal Development Timeline from AboutKidsHealth.ca

The Changes in Each Stage of Human Development

Real Time Presentation of Human Embryo Development

Fetal development week by week at www.babycentre.co.uk

Pregnancy Week by Week

Chart of human fetal development

Development of the human embryo

The Visible Embryo from fertilization to birth

The Human Fertilisation and Embryology Authority (HFEA)

The Process of a Human Fertilized Embryo to Birth

How Pregnancy Happens

[show]v · t · e Human biological and psychological development

Pre- and perinatal Embryo · Fetus

Postnatal development Infant · Toddler · Preschool / Early childhood · Elementary school · Preadolescence · Adolescence · Middle age · Old age

Legal and general definitions Minor · Infancy · Child · Childhood · Adolescence · Age of majority · Adult

Developmental Events and Phases Gestational age · Prenatal development · Child development (stages) · Cognitive development of infants · Human development · Puberty · Ageing · Senescence

Development and Psychology Pre- and perinatal psychology · Infant and child psychology · Adolescent psychology · Youth development · Young adult psychology · Developmental psychology · Psychological maturity

Theorists and

theories Bowlby (Attachment theory) · Bronfenbrenner (Ecological systems theory) · Erikson (Psychosocial development) · Freud (Psychosexual development) · Kohlberg (Moral development) · Piaget (Cognitive development) · Vygotsky (Cultural-historical psychology) · Evolutionary developmental psychology

[show]v · t · e Human physiology and endocrinology of sexual reproduction

Menstrual and estrous cycle Menstruation · Follicular phase · Ovulation · Luteal phase

Gametogenesis Spermatogenesis (spermatogonium · spermatocyte · spermatid · sperm) · Oogenesis (oogonium · oocyte · ootid · ovum) · Germ cell (gonocyte · gamete)

Human sexual behavior Sexual intercourse · Masturbation · Erection · Orgasm · Ejaculation · Insemination · Fertilisation/Fertility · Implantation · Pregnancy · Postpartum period · Mechanics of sex

Life span Prenatal development/Sexual dimorphism/Sexual differentiation (Feminization · Virilization) · Puberty (Gonadarche · Pubarche · Menarche · Adrenarche) · Maternal age / Paternal age · Climacteric (Menopause · Andropause)

Egg (biology) Ovum · Oviposition · Oviparity · Ovoviviparity · Vivipary

Reproductive endocrinology

and infertility Hypothalamic-pituitary-gonadal axis · Andrology · Hormone

Breast Thelarche · Lactation · Breastfeeding · Development

M: ♀ FRS

anat/phys/devp

noco/cong/npls, sysi/epon

proc/asst, drug (G1/G2B/G3CD)

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M: BRE

anat/phys/devp

noco/cong/tumr

proc

[show]v · t · e Pregnancy and childbirth

Planning Birth control · Pre-conception counseling · Natural family planning

Conception Assisted reproductive technology (Artificial insemination, Fertility medication, In vitro fertilisation) · Fertility awareness · Unintended pregnancy

Testing Pregnancy test (Home testing) · 3D ultrasound · Obstetric ultrasonography · Prenatal diagnosis

Prenatal Anatomy Amniotic fluid · Amniotic sac · Endometrium · Placenta

Development Fundal height · Gestational age · Human embryogenesis · Maternal physiological changes

Care Nutrition (and pregnancy) · Concomitant conditions (Diabetes mellitus, SLE)

Procedures Amniocentesis · Chorionic villus sampling · Cardiotocography · Nonstress test

Childbirth Preparation Adaptation to extrauterine life · Bradley method · Hypnobirthing · Lamaze · Nesting instinct

Roles Doula · Midwife · Perinatal nurse · Men's roles · Obstetrician

Delivery Pelvimetry/Bishop score (Cervical dilation, Cervical effacement, Position)

Home birth · Multiple birth · Natural childbirth · Unassisted childbirth · Water birth

Bloody show · Childbirth positions · Contraction · Presentation (Breech, Cephalic, Shoulder) · Rupture of membranes

Postpartum Child care · Congenital disorders · Sex after pregnancy

Obstetric history Gravidity · Parity · Gravida/para/abortus · TPAL

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phys/devp/memb

mthr/fetu/infc, epon

proc, drug (2A/G2C)

[show]v · t · e Developmental biology > Human embryogenesis (development of embryo) and development of fetus (TE E2.0)

First three

weeks Week 1 Fertilization · Oocyte activation · Zygote · Cleavage · Morula · Blastula (Blastomere) · Blastocyst · Inner cell mass

Week 2

(Bilaminar) Hypoblast · Epiblast

Week 3

(Trilaminar) Germ layers Archenteron/Primitive streak (Primitive pit · Primitive knot/Blastopore · Primitive groove) · Gastrula/Gastrulation · Regional specification · Embryonic disc

Ectoderm Surface ectoderm · Neuroectoderm · Somatopleuric mesenchyme · Neurulation · Neural crest

Endoderm Splanchnopleuric mesenchyme

Mesoderm Chorda- · Paraxial (Somite/Somitomere) · Intermediate · Lateral plate (Intraembryonic coelom · Splanchnopleuric mesenchyme/Somatopleuric mesenchyme)

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