DOWNLOAD PDF FETAL GROWTH AND DEVELOPMENT AND GENETIC PRINCIPLES

Chapter 1 : Intrauterine Growth Restriction: Identification and Management - - American Family Physician

The growth and motor development proceeds according to 2 fundamental principles both before and after birth. The Cephalocaudal Principle and the Proximodistal Principle.

There are approximately 30 mL of amniotic fluid present at 10 weeks gestation, and this amount increases to approximately mL at 24 weeks gestation. After that time, the total fluid volume remains fairly stable until it begins to decrease slightly as the pregnancy reaches term. Teaching and Learning Cognitive Level: Information provided by the nurse that addresses the function of the amniotic fluid is that the amniotic fluid helps the fetus to maintain a normal body temperature and also: Facilitates asymmetrical growth of the fetal limbs b. Cushions the fetus from mechanical injury c. Promotes development of muscle tone d. Promotes adherence of fetal lung tissue ANS: Amniotic fluid allows for symmetrical fetal growth. Amniotic fluid cushions the fetus from mechanical injury. Amniotic fluid does not promote muscle tone. Amniotic fluid prevents adherence of the amnion to the fetus. During preconception counseling, the clinic nurse explains that the time period when the fetus is most vulnerable to the effects of teratogens occurs from: During organogenesis, the embryo is extremely vulnerable to teratogens such as medications, alcohol, tobacco, caffeine, illegal drugs, radiation, heavy metals, and maternal TORCH infections. Structural fetal defects are most likely to occur during this period because exposure to teratogens either before or during a critical period of development of an organ can cause a malformation. Physiological Integrity Difficulty Level: A major fetal development characteristic at 16 weeks gestation is: The average fetal weight is grams b. Lanugo covers entire body c. Brown fat begins to develop d. Teeth begin to form ANS: The average fetal weight at 16 weeks is grams. Lanugo is present on the head. Brown fat begins to develop at 20 weeks. This is the correct answer. Karen, a year-old woman, has come for preconception counseling and asks about caring for her cat as she has heard that she should not touch the cat during pregnancy. The clinic nurses best response is: It is best if someone other than you changes the cats litter pan during pregnancy so that you have no risk of toxoplasmosis during pregnancy. It is important to have someone else change the litter pan during pregnancy and also avoid consuming raw vegetables. Have you had any flu-like symptoms since you got your cat? If so, you may have already had toxoplasmosis and there is nothing to worry about. Toxoplasmosis is a concern during pregnancy, so it is important to have someone else change the cats litter pan and also to avoid consuming uncooked meat. The nurse should also explain that the patient should not eat uncooked meat as it is a potential source for toxoplasmosis. Raw vegetables are not a source for toxoplasmosis. This is not an accurate way to diagnose if the woman has had toxoplasmosis. Women need to be aware that Toxoplasma gondii, a single-celled parasite, is responsible for the infection toxoplasmosis. The majority of individuals who become infected with toxoplasmosis are asymptomatic, although when present, symptoms are described as flu like and include glandular pain and enlargement and myalgia. Severe toxoplasmosis infection may cause damage to the fetal brain, eyes, or other organs. Toxoplasmosis is usually acquired by consuming raw or poorly cooked meat that has been contaminated with T. Toxoplasmosis may also be acquired through close contact with feces from an infected animal usually cats or soil that has been contaminated with T. A couple who has sought infertility counseling has been told that the mans sperm count is very low. The nurse advises the couple that spermatogenesis is impaired when which of the following occur? The testes are overheated. The vas deferens is ligated. The prostate gland is enlarged. The flagella are segmented. Spermatogenesis occurs in the testes. High temperatures harm the development of the sperm. When the vas deferens is ligated, a man has had a vasectomy and is sterile. The sterility is not due to impaired spermatogenesis, but rather to the inability of the sperm to migrate to the womans reproductive track. The enlarged prostrate has no effect on spermatogenesis. The flagella are the tails of the sperm. They are normally divided into the middle segment and an end segment. Health Promotion and Maintenance Difficulty Level: A nurse working with an infertile couple has made the following nursing diagnosis: Sexual dysfunction related to decreased libido. Which of the following assessments is the likely reason for this diagnosis? The couple has established a set schedule for their sexual encounters. The couple has been married for more than 8 years. The couple lives with one set of parents. The couple has close friends who gave birth within the last year. Couples who schedule intercourse often complain that their sexual relationship is unsatisfying. Years of marriage are not directly related to a couples sexual relationship. The fact that the couple lives with one set of parents is unlikely related to their sexual relationship. Although it can be very difficult to be around couples who have become pregnant or have healthy babies, this factor is not usually related to a couples sexual relationship. Critical Thinking Cognitive Level: The perinatal nurse explains to the student nurse that in the fetal circulation, the lowest level of oxygen concentration is found in the umbilical arteries. The blood with the highest oxygen content is delivered to the fetal heart, head, neck, and upper limbs, and the blood with the lowest oxygen content is shunted toward the placenta. This event triggers an increased secretion of prolactin the hormone that stimulates milk production by the anterior pituitary gland. The posterior pituitary and hypothalamus play a role in the production and secretion of oxytocin, a hormone that causes release of milk from the alveoli. During prenatal class, the childbirth educator describes the two membranes that envelop the fetus. The thick chorion, or outer membrane, forms first. It develops from the trophoblast and encloses the amnion, embryo, and yolk sac. The amnion arises from the ectoderm during early embryonic development. The amnion is a thin, protective structure that contains the amniotic fluid. With embryonic growth, the amnion expands and comes into contact with the chorion. The two fetal membranes are slightly adherent and form the amniotic sac. Most of the blood bypasses the liver and then enters the inferior vena cava by way of the ductus venosus, a vascular channel that connects the umbilical vein to the inferior vena cava. The blood then empties into the right atrium, passes through the foramen ovale an opening in the septum between the right and left atrium into the left atrium, and then moves into the right ventricle and on into the aorta. From the aorta, blood travels to the head, upper extremities, and lower extremities. During this time, the developing organism is called an embryo. By the end of 8 weeks, the embryo has sufficiently developed to be called a fetus. Gamete intrafallopian transfer Gamete intrafallopian transfer, also referred to as GIFT, is used when there is a history of failed infertility treatment for anovulation, or unexplained infertility, or low sperm count. Moderate Multiple Response A woman seeks care at an infertility clinic. Which of the following tests may this woman undergo to determine what, if any, infertility problem she may have? Select all that apply.

Chapter 2 : Evolutionary developmental biology - Wikipedia

During embryonal and fetal development, the fertilized oocyte changes into a complete organism representing the species by which the oocyte was produced. Differentiation and growth are genetically determined.

Feedback Genetics Regulates Fetal Development Massive information has been generated from ongoing research in field of genetics. Consequently, today we know the structure of normal human genome and many inherited disorders. Inherited recessive, dominant and sex linked genes determine the mode of transmission of various characters to the fetus. Progression and transformation of a single fertilized cell in to a baby is intricate and vast. Human genome is comprised of thousands of genes; the current known number is twenty-five thousand. Genes Genes are very tiny structures located on the chromosome of the cell nucleus. They are the packets of our inheritance codes; not visible by any form of microscopy. Genes carry the instruction brochure for each cell, describing their function in the body, and they accomplishes its own functions in the body through specific proteins. Any alteration in protein structure or sequence can result in genetically mediated diseases and birth defects. Each cell in the body has a pair of each gene. Only the gametes reproductive cells: Thereby, a baby gets one copy of genes from each of her parent to form her own genome: Where are genes located? As the baby evolves from a single cell, the zygote fertilized egg , each new cell formed gets a pair of genes. In cell, genes are packed together, in a definite sequence of proteins, on a two stranded spiral structure, the chromosome. Chromosomes The chromosome is a single piece of coiled DNA deoxyribonucleic acid. It contains precisely only those genes that a child inherits from the parents. Like genes, chromosomes are also arranged in pairs in the nucleus of cells: Each cell has 23 pairs, which amount to total of 46 chromosomes. The remaining 22 pairs are called autosomal chromosomes. Except for the male sex chromosome XY , the two chromosomes that form a pair coincide in their characteristics; such as size, shape and heredity. However, the gametes reproductive cells: Reduction in total number of chromosomes of a cell is achieved by cell division process known as Meiosis division. The moment ovum and sperm unite, the fertilized egg zygote so formed again has 46 chromosomes arranged as 23 pairs. A child thus inherits one copy of each chromosome pair from each of her parent: Zygote, the fertilized ovum At conception, fertilization of ovum by sperm forms a single cell known as "zygote". The zygote divides, multiplies and differentiates in to millions of cells that form various organ systems and structures of our body. This intricate progression and vast transformation towards fetal development is regulated by genes inherited. So, is it surprising that many babies are born with birth defects? The prevalence of birth defects ranges from 2. Most birth defects are identifiable in the neonates , but some may get detected only later as the infant grows. Effects of genes on child health Gene injury Gene damage and mutations are the leading cause of early abortions. Genetic abnormalities in aborted product of conception are noted in more than half of abortions that occur within the first 3 months of pregnancy. Childhood morbidity and mortality It has been noted that almost 50 percent of infants and children who need frequent hospitalization suffer from ailment attributable to an underlying genetic defect or predisposition. Basis of evolution of identical twin fetuses During the first 3 to 5 days, zygote undergoes mitotic divisions giving rise to identical omnipotent daughter cells. One of the daughter cells may accidentaly get separate from rest of the group before they get compacted together. The separated cell does not die nor the remaining cells suffer any damage. Mitosis generated daughter cells of zygote have equal potential to evolve in to a normal baby. Consequently, two identical groups of cells get formed with identical genetic potential to evolve into a normal human baby. Result is that a pair of identical twins are formed. The identical twins originate from different daughter cells of the same zygote. They are therefore also called monozygotic twins. The genetic make up of monozygotic pair of twins is absolutely identical. Estimated rate of prevalence of identical twins is believed to be low all over the world; approximately 3 in every births. Various ways in which genes are expressed Dominant-recessive form of genetic endowment This implies that In a pair of genes, one member dominates over the other. What is a dominant gene? Gene is called dominant when it has more potential to express itself as physical characteristics of a child. Its influence on the biochemical and physiological functions of the body are also prominently noticeable. It masks the effect of its partner in the gene pair. What is a recessive gene? If in gene pair it is paired with a dominant gene, Its capacity to express itself in the physical, physiological and biochemical traits of the child. What is co-dominance inheritance? Here both the partners of a gene pair that have differences in their coding are expressed completely. In such mode of inheritance neither of the gene partner in the pair dominate over each other, for example; genetic representation for blood group AB. Co-dominance form of inheritance can also be seen in cases where when one gene in the pair is dominant and has a higher potential to express itself, but fails to mask all the expressions of its partner. This is the genetic representation of sickle-cell anemia. What is the meaning of genetic imprinting? Normally every gene pair has one gene from each parent. Sex linked Inheritance It is the expression of genes that are located on the sex chromosomes. With the advanced knowledge of genome and mode of inheritance, there have been advancements in prenatal genetics screening for evaluation of zygote and if required gene therapy. This forms a major step towards prevention of genetically related chronic disabilities in children. Related pages of interest.

Chapter 3 : Prenatal Development: Growth, Differentiation, and Their Disturbances | GLOWM

Genetics Regulates Fetal Development. Massive information has been generated from ongoing research in field of genetics. Consequently, today we know the structure of normal human genome and many inherited disorders.

For example, the brain of a human embryo looked first like that of a fish , then in turn like that of a reptile , bird , and mammal before becoming clearly human. The embryologist Karl Ernst von Baer opposed this, arguing in that there was no linear sequence as in the great chain of being, based on a single body plan , but a process of epigenesis in which structures differentiate. Von Baer instead recognised four distinct animal body plans: Zoologists then largely abandoned recapitulation, though Ernst Haeckel revived it in Lancelet a chordate , B. Larval tunicate , C. Kowalevsky saw that the notochord 1 and gill slit 5 are shared by tunicates and vertebrates. Morphology biology and Body plan From the early 19th century through most of the 20th century, embryology faced a mystery. Animals were seen to develop into adults of widely differing body plan , often through similar stages, from the egg, but zoologists knew almost nothing about how embryonic development was controlled at the molecular level , and therefore equally little about how developmental processes had evolved. As an example of this, Darwin cited in his book On the Origin of Species the shrimp -like larva of the barnacle , whose sessile adults looked nothing like other arthropods ; Linnaeus and Cuvier had classified them as molluscs. It took a century before these ideas were shown to be correct. Biologists assumed that an organism was a straightforward reflection of its component genes: Biochemical pathways and, they supposed, new species evolved through mutations in these genes. It was a simple, clear and nearly comprehensive picture: RNA Polymerase , 2: It was a cluster of genes , arranged in a feedback control loop so that its products would only be made when "switched on" by an environmental stimulus. One of these products was an enzyme that splits a sugar , lactose; and lactose itself was the stimulus that switched the genes on. This was a revelation, as it showed for the first time that genes, even in an organism as small as a bacterium, were subject to fine-grained control. The implication was that many other genes were also elaborately regulated. Lewis discovered homeotic genes that regulate embryonic development in Drosophila fruit flies, which like all insects are arthropods , one of the major phyla of invertebrate animals. It was evident that the gene must be ancient, dating back to the last common ancestor of bilateral animals before the Ediacaran Period, which began some million years ago. Evo-devo had started to uncover the ways that all animal bodies were built during development. Deep homology Roughly spherical eggs of different animals give rise to extremely different bodies, from jellyfish to lobsters, butterflies to elephants. Many of these organisms share the same structural genes for body-building proteins like collagen and enzymes, but biologists had expected that each group of animals would have its own rules of development. The surprise of evo-devo is that the shaping of bodies is controlled by a rather small percentage of genes, and that these regulatory genes are ancient, shared by all animals. The giraffe does not have a gene for a long neck, any more than the elephant has a gene for a big body. Their bodies are patterned by a system of switching which causes development of different features to begin earlier or later, to occur in this or that part of the embryo, and to continue for more or less time. The step-by-step control of its embryogenesis was visualized by attaching fluorescent dyes of different colours to specific types of protein made by genes expressed in the embryo. Using such a technique, in Walter Gehring found that the pax-6 gene, vital for forming the eyes of fruit flies, exactly matches an eye-forming gene in mice and humans. The same gene was quickly found in many other groups of animals, such as squid , a cephalopod mollusc. Biologists including Ernst Mayr had believed that eyes had arisen in the animal kingdom at least 40 times, as the anatomy of different types of eye varies widely.

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Chapter 4 : Stages Of Pregnancy & Fetal Development | Cleveland Clinic

Pregnancy and Prenatal Development â€¢Fetal stage -Fetus â€¢Principles of development: Child Growth and Development Pregnancy and Prenatal Development Chapter 4.

Find articles by Joan Stiles Terry L. Received Aug 7; Accepted Oct Abstract Over the past several decades, significant advances have been made in our understanding of the basic stages and mechanisms of mammalian brain development. Studies elucidating the neurobiology of brain development span the levels of neural organization from the macroanatomic, to the cellular, to the molecular. Together this large body of work provides a picture of brain development as the product of a complex series of dynamic and adaptive processes operating within a highly constrained, genetically organized but constantly changing context. The view of brain development that has emerged from the developmental neurobiology literature presents both challenges and opportunities to psychologists seeking to understand the fundamental processes that underlie social and cognitive development, and the neural systems that mediate them. This chapter is intended to provide an overview of some very basic principles of brain development, drawn from contemporary developmental neurobiology, that may be of use to investigators from a wide range of disciplines. Brain development; maturation, Magnetic resonance imaging, Diffusion weighted imaging, Genetic patterning of brain, Neurogenesis, Myelination, Effects of experience on connectivity Human brain development is a protracted process that begins in the third gestational week GW with the differentiation of the neural progenitor cells and extends at least through late adolescence, arguably throughout the lifespan. The processes that contribute to brain development range from the molecular events of gene expression to environmental input. Critically, these very different levels and kinds of processes interact to support the ongoing series of events that define brain development. Both gene expression and environmental input are essential for normal brain development, and disruption of either can fundamentally alter neural outcomes. But neither genes nor input is prescriptive or determinative of outcome. Rather brain development is aptly characterized as a complex series of dynamic and adaptive processes that operate throughout the course of development to promote the emergence and differentiation of new neural structures and functions. These processes operate within highly constrained and genetically organized, but constantly changing contexts that, over time, support the emergence of the complex and dynamic structure of the human brain Waddington ; Morange ; Stiles This paper will review some of the major events that contribute to the development of the human brain from its early embryonic state through adolescence. It begins by examining the foundational changes that occur during the embryonic period, which in humans extends through the eighth week post conception gestational week eight, or GW8. By the end of the embryonic period the rudimentary structures of the brain and central nervous system are established and the major compartments of the central and peripheral nervous systems are defined see Fig. The ensuing period of fetal development extends through the end of gestation. During this time there is rapid growth and elaboration of both cortical and subcortical structures, including the rudiments of the major fiber pathways Kostovic and Jovanov-Milosevic ; Kostovic and Jovanov-Milosevic Changes in the gross morphology of the prenatal neural system are underpinned by changes occurring at the cellular level. Neuron production in humans begins on embryonic day As they are produced neurons migrate to different brain areas where they begin to make connections with other neurons establishing rudimentary neural networks. By the end of the prenatal period major fiber pathways, including the thalamocortical pathway, are complete.

DOWNLOAD PDF FETAL GROWTH AND DEVELOPMENT AND GENETIC PRINCIPLES

Chapter 5 : Prenatal Development

Genetics, Conception, and Fetal Development C hapter SHANNON E. PERRY 7 â€¢ Explain the key concepts of basic human genetics. â€¢ Discuss the purpose, key findings, and potential.

URL of this page: It is measured in weeks. This means that during weeks 1 and 2 of pregnancy, a woman is not yet pregnant. This is when her body is preparing for a baby. A normal gestation lasts anywhere from 37 to 42 weeks. She is not yet pregnant. During the end of the second week, an egg is released from an ovary. This is when you are most likely to conceive if you have unprotected intercourse. Week 3 During intercourse, sperm enters the vagina after the man ejaculates. The strongest sperm will travel through the cervix the opening of the womb, or uterus , and into the fallopian tubes. When the single sperm enters the egg, conception occurs. The combined sperm and egg is called a zygote. The zygote contains all of the genetic information DNA needed to become a baby. The zygote spends the next few days traveling down the fallopian tube. During this time, it divides to form a ball of cells called a blastocyst. A blastocyst is made up of an inner group of cells with an outer shell. The inner group of cells will become the embryo. The embryo is what will develop into your baby. The outer group of cells will become structures, called membranes, which nourish and protect the embryo. Week 4 Once the blastocyst reaches the uterus, it buries itself in the uterine wall. Watch this video about: Cell division Week 5 Week 5 is the start of the "embryonic period. This is called differentiation. Blood cells, kidney cells, and nerve cells all develop. It is during this time in the first trimester that the baby is most at risk for damage from things that may cause birth defects. This includes certain medicines, illegal drug use, heavy alcohol use, infections such as rubella, and other factors. Weeks 6 to 7 Arm and leg buds start to grow. Some cranial nerves are visible. Eyes and ears begin to form. Blood pumps through the main vessels. Hands and feet begin to form and look like little paddles. The lungs start to form. Week 9 Nipples and hair follicles form. Arms grow and elbows develop. The outer ears begin to take shape. At the end of the 10th week of pregnancy, your baby is no longer an embryo. It is now a fetus, the stage of development up until birth. Limbs are long and thin. Nails appear on the fingers and toes. Your little one can now make a fist. Tooth buds appear for the baby teeth. Muscle tissue and bones keep developing, and bones become harder. Baby begins to move and stretch. The liver and pancreas produce secretions. Your little one now makes sucking motions. Weeks 19 to 21 Your baby can hear. The baby is more active and continues to move and float around. The mother may feel a fluttering in the lower abdomen. By the end of this time, baby can swallow. Eyebrows and lashes appear. The baby is more active with increased muscle development. The mother can feel the baby moving. Weeks 23 to 25 Bone marrow begins to make blood cells. Your baby begins to store fat. Week 26 Eyebrows and eyelashes are well-formed. Your baby may startle in response to loud noises. Footprints and fingerprints are forming. Weeks 27 to 30 The nervous system is developed enough to control some body functions. The respiratory system, while immature, produces surfactant. This substance helps the air sacs fill with air. Weeks 31 to 34 Your baby grows quickly and gains a lot of fat. Your baby keeps gaining weight, but will probably not get much longer. The skin is not as wrinkled as fat forms under the skin. Baby has definite sleeping patterns. Muscles and bones are fully developed. Week 38 to 40 Lanugo is gone except for on the upper arms and shoulders. Fingernails may extend beyond fingertips. Small breast buds are present on both sexes. Head hair is now coarse and thicker. In your 40th week of pregnancy, it has been 38 weeks since conception, and your baby could be born any day now.

Chapter 6 : Genetics in Fetal Development

Week 5. Week 5 is the start of the "embryonic period." This is when all the baby's major systems and structures develop. The embryo's cells multiply and start to take on specific functions.

Two-cell stage stage 2. In vitro fertilization, 36 hours after exposure of oocyte to sperm in tissue culture. Lateral view of an unsectioned bilaminar embryo consisting of amnionic sac A and secondary yolk sac Y attached by connecting stalk to the chorion stage 4â€"3 Fig. Tranverse section of the embryo shown in Figure 3. A, amnionic sac; Y, yolk sac Fig. Unsectioned trilaminar human embryo. The yolk sac was dissected. The endodermal surface of the pear-shaped embryonic disk shows a distinct primitive groove stage 5â€"2 Fig. Lateral view of an unsectioned embryo after the chorionic vesicle has been dissected stage 5â€"2. Y, yolk sac; A, amnionic sac; EC, endodermal cyst Fig. Dorsal view of an unsectioned embryo with seven somites and closing medullary tube stage 6â€"2 Fig. Dorsal view of embryo with 14 paired somites, using scanning electron microscopy stage 6â€"2 Fig. Scanning electron microscopy showing C-shaped somite embryo with three pharyngeal arches. Lateral mesoderm is condensed into a distinct ridge related to the development of extremities. Yolk sac is removed stage 7â€"1 Fig. Scanning electron microscopy showing embryo with limb buds and four pharyngeal arches stage 7â€"2 Fig. Scanning electron microscopy showing embryo with segmenting primordia of extremities stage 7â€"4 Fig. Implanted product of conception covered by decidualized endometrium bulging into the uterine cavity stage 7â€"4 Fig. The decidua and chorion have been dissected and the amnionic sac has been exposed stage 7â€"4. This is the same specimen as in Figure The amnionic sac has been dissected, and the embryo attached to the chorion by a relatively thick umbilical cord has been exposed stage 7â€"4. Embryo from the end of the embryonal period enclosed within the amnionic sac and attached to the chorion CH and yolk sac Y stage 8â€"1 Prenatal development is influenced by various external factors. The prenatal sensitivity of an individual to external factors, including xenobiotics, varies according to the stage of development. Generally, if the mammalian embryo is exposed to damaging agents during blastogenesis corresponding to human gestational weeks 3â€"4 , either the embryo is killed and subsequently aborted, or it survives without any anatomic defects. If the embryo is exposed to nociceptive influences during the organogenic period corresponding to human gestational weeks 5â€"10 , the probability of anatomic malformations is high. Mechanical injuries causing amnionic ruptures and bleeding into the amnionic cavity, especially during gestational weeks 8â€"12, may produce limb amputations and facial disruptions related to blood clotting and, consequently, fibrin cords and deposits on the surface of the embryo or fetus Fig. The affected embryo usually survives and is not aborted, but it is malformed. During the fetal and perinatal periods, the probability of anatomic malformations decreases; however, damage to the brain and the sense organs ears, eyes can never be ruled out. Fetal death followed by abortion can occur at any stage of prenatal development. In humans, serious brain damage during the perinatal period becomes manifested relatively late postnatally as psychomotoric and mental retardation. Multiple malformations are caused by bleeding into amnionic cavity from the ruptured umbilical vein near abdominal insertion of umbilical cord. The intrauterine survival of the conceptus depends mostly on uteroplacental and fetoplacental circulations. Fetal brain and kidneys are unimportant for intrauterine survival: The early extrauterine survival of the newborn depends on respiratory and circulatory adaptations and on neurovegetative integrations. Obstruction of the intestinal passage and urination are tolerated in newborns for a period of 2â€"3 postnatal days. Ill-Defined Biological Factors Growth retardation is more frequent in smoking mothers. Full-term newborns of smoking mothers are approximately g lighter than newborns of nonsmokers. Regarding maternal height, weight, nutrition, and parity, there is a good correlation between the maternal weight and the placental and fetal size. If the diet during the last trimester of pregnancy is inadequate, the fetal birth weight, length, and head circumference will be smaller. In relation to the placental weight, twins are lighter than singletons. Placental size active surface seems to be a determinant of fetal growth. Growth-retarded fetuses tend to be heavier in relation to the weight of the placenta i. Genes are classified as structural and regulatory. There are three types of structural genes: Regulatory genes bind to DNA and regulate sequences of expression of other structural genes. Many regulatory genes contain an approximately nucleotide-long sequence known as the homeobox. The homeoboxes are shared by genes of very different animals, such as flies Drosophila , chicks, mice, and humans. Homeobox genes code for the basic organization of the embryonal body. These products have the following types of action: Substances act in the cells of their origin. Substances diffuse spread in the neighborhood of the cell or tissue of their origin. Some paracrine actions are correlated to embryonal inductions. Substances are released from the cell of their origin into the blood stream. Integrins and syndecans are transmembrane proteoglycans. The intracellular domain ends with a hydrophilic carboxy group. Integrins bind with extracellular matrix; the ligands for integrin alfa 3, beta 1 bind with collagen, laminin, and fibronectin. Syndecans bind to heparan sulfate, chondroitin sulfate, fibrin collagens, fibronectin, and tenascin. If the extracellular domain of syndecans is attached to the surface of an adjacent cell, the intracellular domain binds to the cytoskeleton. Syndecans participate in cellular polarization of epithelial cells in the basolateral cellular surface. Syndecans are present in epithelia as well as mesenchymal cells. Prenatally, insulin is the main factor regulating fetal growth Transforming growth factor family: Next, growth factors trigger intracellular messengers, including phosphoproteins phospholipase C, phosphatidyl inositol. Some growth factors exhibit a protein tyrosinase and protein kinase C activity. The bulk of the energy required for growth and differentiation is produced by mitochondria. The mitochondria contain their own mitochondrial genome. All mitochondria in an individual are maternally derived. Disturbances of the mitochondrial genome are maternally inherited. Using anaerobic glycolysis, 2 mol of adenosine triphosphate ATP are produced from 1 mol of glucose; in contrast, by much more effective aerobic glycolysis, 36 mol of ATP are formed from 1 mol of glucose. Mammalian prenatal development occurs under hypoxic conditions in an environment that is well balanced for pH and temperature. Disorders of the nuclear genome errors of nuclear DNA and chromosomes: Chromosomal disorders disorders of number and shape of chromosomes Monogenic disorders with mendelian inheritance: Teratogens are classified as biological, chemical, and physical: Biological teratogens are maternal diseases, such as diabetes and some infections. Chemical teratogens are toxic chemicals, including some medicaments. Physical teratogens are high temperature, ionizing radiation x-rays , and mechanical injuries. The most common trisomy occurring in spontaneous abortions is trisomy of chromosome Monogenic defects include metabolic as well as dysmorphic disorders. Some are characterized by specific metabolic and morphologic sequences related to storage of excessive metabolites. Combinations of more or less constant anomalies and malformations are classified as syndromes or sequences. The number of monogenic syndromes all exhibiting mendelian inheritance that exhibit disturbances of growth and differentiation exceeds several thousand. The defects are related to the metabolism of ATP. The defects include substrate transport carnitine , energy conservation ATP , and cytochrome deficiencies. There is a definitive increase in malformation among offspring of diabetic mothers. There are two groups of anomalies related to maternal diabetes: The increased frequency of malformations can be correlated with inadequate treatment of diabetes during the first trimester of pregnancy. Such fetuses are supplied with excessive glucose. Excessive fetal glucose utilization due to an excessive maternal glucose supply increases the growth of the placenta and fetus. In fetuses of diabetic mothers exhibiting excessive growth, there is accumulation of fat and visceromegaly of the heart and liver. The action of a teratogen is related to the developmental period of the embryo or fetus at the time of its intake by the mother. The following are recognized human teratogens:

Chapter 7 : The Basics of Brain Development

The development stages of pregnancy are called trimesters, or three-month periods, because of the distinct changes that occur in each stage. Stages of Growth: Month by Month Month 1.

Approximately days, or 38 weeks, elapse from the date of fertilization to the birth of the baby. This period of time is referred to as the prenatal stage of development. Although growth during this time is highly continuous, scientists have divided prenatal development into three time periods: An alternative approach divides this time into three successive trimesters, or three-month periods. The first two weeks of the prenatal stage are referred to as the period of the zygote. In this first two week period, cells begin to divide at a very rapid rate and the cells begin to differentiate into distinct layers that will eventually form individual organ systems. The period of the embryo begins at the end of the second week and extends to the end of the eighth week following conception. During this 6 weeks all of the major organ systems of the baby are structurally formed with the exception of the genitals. The third and final period of prenatal development is the period of the fetus. Click this Websource and select the numbers to see images of prenatal growth: Click to view animation of conception and prenatal development. The rapid development of the organ systems during the period of the embryo results in considerable vulnerability to negative outside influences. These influences will be discussed in detail later in this chapter. The Period of the Zygote The first two weeks following fertilization are known as the period of the zygote. For about the first three days of this period, the zygote fertilized egg will remain in the fallopian tube. The original cell divides into two cells at 36 hours, followed by several more divisions: By 72 hours it has developed into a ball of cells, which is transported along the fallopian tube toward the uterus. The ball of cells will continue to enlarge as it approaches and enters into the uterus, where it will continue to grow while it floats for another three to four days. By the beginning of the second week, the hollow, fluid-filled ball of cells is referred to as the blastocyst. Seven to nine days after fertilization, the blastocyst embeds itself into the endometrial lining of the uterus in a process known as implantation. This is a risky process: Failure to implant may result from several causes, including inadequate hormonal preparation of the endometrium or abnormal development of the blastocyst. Once the blastocyst is embedded in the endometrium, the placenta rapidly begins to form. The two blood supplies do not actually mix. The placenta is attached to the baby by the umbilical cord, a tube containing two arteries and one vein which is pressurized to prevent tangling. The placenta, umbilical cord, the amniotic sac and the embryo itself all derive from the original fertilized egg and contain only the DNA of the baby. By the fourteenth day, the growing ball of cells begins to differentiate into three distinct layers of cells, each of which is destined to form specific organ systems. The outermost layer called the ectoderm, develops into into the brain, the spinal cord, the nerves, and the skin. The intermediate layer, the mesoderm, forms the skeletal system, muscles, heart, and kidneys. The innermost layer, or endoderm, becomes the digestive tract, the respiratory system, pancreas, and liver. The developing organism is now referred to as an embryo. The Period of the Embryo The period of the embryo extends from the beginning of the third week to the end of the eighth week of pregnancy. During these critical six weeks, the structure of all the major organ systems except the genitals is established, a process known as organogenesis. Each organ begins and completes its development according to a specific, genetically determined timetable. The time when an organ is developing most rapidly is its critical period. The critical period for selected organ systems is illustrated in Figure 3. By the end of the embryonic period, the organism takes on a distinctly human form and many of its systems have begun to function. Organogenesis proceeds at a truly astonishing rate during this period. By the end of the eighth week, the nervous system, heart, kidneys and liver have begun to function. All of this has been accomplished in an organism that is approximately one inch long and weighs about one seventh of an ounce. Two principles of growth and development have been used to describe physical development during the period of the embryo. First, the cephalocaudal principle describes a growth trend from head to toe with growth of the head proceeding at a more rapid rate than the lower parts of the body. This is reflected in the disproportionately large size of the head early in this period. The proximodistal principle describes a second trend in which development proceeds from the center or proximal regions of the body out toward the extremities or distal parts. Thus, arm buds and leg buds appear early in this period, followed progressively by the upper arms and upper legs and finally, by the development of the forearm and lower legs. Webbed fingers and toes appear toward the sixth week. The Period of the Fetus The final and longest stage of prenatal development, the period of the fetus, extends from the beginning of the ninth week to birth about seven months. Body movements increase steadily between ten and sixteen weeks, in both intensity and variety, and by sixteen weeks the mother can usually begin to feel the quickening, the sensation of the fetus kicking against her abdomen. By the eighteenth week, this movement slows as a result of advances in the regulatory functions of the higher centers of the fetal brain. Modern advances in medical care have begun to help babies born before 26 seeks to survive, but the risk is very high.

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The placenta attaches a fetus to a woman's uterine wall, bringing maternal blood vessels close to fetal vessels. Important nutrients and other positive factors pass from the mother's blood into the fetal blood, helping support fetal growth and development.

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Chapter 9 : Core Principles in Genetics

The development from prenetal to postnatal behaviour is a gradual process, related to growth. The new born infant has postural reflexes which include the movement of the arms.

The start of pregnancy is actually the first day of your last menstrual period. The eggs develop in small fluid-filled cysts called follicles. Normally, one follicle in the group is selected to complete maturation. This dominant follicle suppresses all the other follicles in the group, which stop growing and degenerate. The mature follicle opens and releases the egg from the ovary ovulation. After ovulation, the ruptured follicle develops into a structure called the corpus luteum, which secretes progesterone and estrogen. The progesterone helps prepare the endometrium lining of the uterus for the embryo to implant. On average, fertilization occurs about two weeks after your last menstrual period. When the sperm penetrates the egg, changes occur in the protein coating around it to prevent other sperm from entering. If a Y sperm fertilizes the egg, your baby will be a boy; if an X sperm fertilizes the egg, your baby will be a girl. Human chorionic gonadotrophin hCG is a hormone present in your blood from the time of conception. It is produced by cells that form the placenta and is the hormone detected in a pregnancy test. However, it usually takes three to four weeks from the first day of your last period for the hCG to increase enough to be detected by pregnancy tests. Within 24 hours after fertilization, the egg begins dividing rapidly into many cells. It remains in the fallopian tube for about three days. The fertilized egg called a blastocyte continues to divide as it passes slowly through the fallopian tube to the uterus where its next job is to attach to the endometrium a process called implantation. Before this happens, the blastocyte breaks out of its protective covering. When the blastocyte establishes contact with the endometrium, an exchange of hormones helps the blastocyte attach. Some women notice spotting or slight bleeding for one or two days around the time of implantation. The endometrium becomes thicker and the cervix is sealed by a plug of mucus. Your developing baby is called an embryo from the moment of conception to the eighth week of pregnancy. After the eighth week and until the moment of birth, your developing baby is called a fetus. The development stages of pregnancy are called trimesters, or three-month periods, because of the distinct changes that occur in each stage. Month by Month Month 1 As the fertilized egg grows, a water-tight sac forms around it, gradually filling with fluid. This is called the amniotic sac, and it helps cushion the growing embryo. The placenta also develops. The placenta is a round, flat organ that transfers nutrients from the mother to the baby, and transfers wastes from the baby. A primitive face will take form with large dark circles for eyes. The mouth, lower jaw, and throat are developing. Blood cells are taking shape, and circulation will begin. The tiny "heart" tube will beat 65 times a minute by the end of the fourth week. Each ear begins as a little fold of skin at the side of the head. Tiny buds that eventually grow into arms and legs are forming. Fingers, toes and eyes are also forming. The neural tube brain, spinal cord and other neural tissue of the central nervous system is well formed. The digestive tract and sensory organs begin to develop. Bone starts to replace cartilage. After the 8th week, your baby is called a fetus instead of an embryo. Your baby can open and close its fists and mouth. Fingernails and toenails are beginning to develop and the external ears are formed. The beginnings of teeth are forming. By the end of the third month, your baby is fully formed. All the organs and extremities are present and will continue to mature in order to become functional. The circulatory and urinary systems are working and the liver produces bile. At the end of the third month, your baby is about 4 inches long and weighs about 1 ounce. The fingers and toes are well-defined. Eyelids, eyebrows, eyelashes, nails, and hair are formed. Teeth and bones become denser. Your baby can even suck his or her thumb, yawn, stretch, and make faces. The nervous system is starting to function. The reproductive organs and genitalia are now fully developed, and your doctor can see on ultrasound if you are having a boy or a girl. By the end of the fourth month, your baby is about 6 inches long and weighs about 4 ounces. Month 5 You may begin to feel your baby move, since he or she is developing muscles and exercising them. This first movement is called quickening. This coating is shed just before birth.

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The eyelids begin to part and the eyes open. Baby responds to sounds by moving or increasing the pulse. You may notice jerking motions if baby hiccups. If born prematurely , your baby may survive after the 23rd week with intensive care. By the end of the sixth month, your baby is about 12 inches long and weighs about 2 pounds. Month 7 Your baby will continue to mature and develop reserves of body fat. He or she changes position frequently and responds to stimuli, including sound, pain, and light. The amniotic fluid begins to diminish. At the end of the seventh month, your baby is about 14 inches long and weighs from 2 to 4 pounds. If born prematurely, your baby would be likely to survive after the seventh month. Month 8 Your baby will continue to mature and develop reserves of body fat. You may notice that your baby is kicking more. Most internal systems are well developed, but the lungs may still be immature. Your baby is about 18 inches long and weighs as much as 5 pounds. Month 9 Your baby continues to grow and mature: Baby is definitely ready to enter the world! You may notice that your baby moves less due to tight space. The baby drops down in your pelvis. Your baby is about 18 to 20 inches long and weighs about 7 pounds. Cleveland Clinic is a non-profit academic medical center. Advertising on our site helps support our mission. We do not endorse non-Cleveland Clinic products or services.