In an earlier time children were considered to be miniature adults. However, in the 20th century children have come to be viewed as unique from adults in their growth and development. Today, research on children's growth and development examines both the prenatal and postnatal period. Research on the prenatal period focuses on the effects of the prenatal environment on the mother and the fetus and the influence on the growth and development of the child. This Guide follows growth and development from conception to birth.

The uniting of two cells into one at the moment of conception is the beginning of life for each and every person. The female produces one mature ovum or egg approximately every 28 days, and the male produces many sperm cells. Sperm cells contact the ovum, but only one sperm unites with the ovum to form a single cell, the zygote, which develops into a human being. The sex of the child is determined by the sperm.

Each month one of the ovaries releases an egg. Conception occurs during a period of 4 to 5 days in each menstrual cycle while the egg is traveling through the fallopian tubes. The egg cannot be fertilized in the ovary or in the uterus.
Implantation: By the end of approximately two weeks the organism is ready to anchor itself to the lining of the uterus. This process is called implantation. Implantation begins the development of the placenta, the part of the uterus that will furnish nourishment to the baby. This starts at about the 12th day of pregnancy as the uterine tissue and blood vessels begin to form small spaces that fill with blood. The placenta will grow into a complex network of tissue and blood vessels and will eventually connect to the baby by the umbilical cord. The placenta helps to fight internal infection and gives immunity to various diseases. It also produces hormones that support pregnancy and prepare the mother’s breasts for lactation.

The Embryonic Period
(Two to Eight Weeks)

The baby is now called an embryo.

- During the next six weeks various organ systems start to emerge.
- The heart, a U-shaped tube, is usually beating by the fourth week.
- A simple brain, rudimentary kidneys, a liver, a digestive tract and a primitive umbilical cord emerge.
- The four week old embryo is about one-fourth of an inch (½ centimeter) long (about 10,000 times larger than the original fertilized egg).
- The placenta, umbilical cord and amniotic sac have formed. Through the umbilical cord, the placenta delivers oxygen and nourishment from the mother and absorbs the body wastes of the embryo.

The amniotic sac is a fluid-filled membrane that encloses the developing baby. It protects the baby and allows for room to move.

By the end of the embryonic period, about eight weeks from conception, the organism is about one inch (2.5 centimeters) long. The head is distinct from the rounded skin-covered body and is about one-half the embryo’s total size. The eyes have come forward from the side of the head; eyelids have begun to form; the face contains ears, nose, lips, tongue and even the buds of teeth.

The knobs that will be arms and legs grow and by eight weeks the knobs have differentiated into hands and feet and then into fingers and toes.

During this six-week period there is rapid growth and development; therefore, the developing baby is most vulnerable to prenatal environmental influences.

During the embryonic period, protein, energy, vitamins and minerals are needed by the embryo for normal growth and development. The mother needs to be well nourished before and during pregnancy in order to nourish the rapidly developing body structure of the embryo.

The Fetal Period
(Eight Weeks to Birth)

The appearance of the first bone cells is the physical event that determines the change from embryo to fetus. This is a strictly arbitrary designation.

The third lunar month (12 weeks)

- fetus is about three inches (8 to 10 centimeters) long and weighs about one ounce (28 grams)
- head is relatively large, with prominent forehead
- a nose, external ears level with the lower jaw and eyelids sealed shut
- buds for all twenty temporary teeth
- vocal cords appear
- ribs and vertebrae turn to hard cartilage
- nails begin to grow on well-developed fingers and toes
- can kick legs, turn feet, close fingers, bend wrist, turn head, frown, open and close mouth
The fourth lunar month (16 weeks)
- Head size is now about one-fourth of total body size
- About 6 to 8 inches (15-20 centimeters) long and weighs about 150 grams
- Perfects form and functioning of internal organs and external features. Sex can now be determined

The fifth lunar month (20 weeks)
- Movements often readily perceived by the mother known as quickening. This occurs about 18-19 weeks in primigravida (first pregnancy) and 16-17 weeks in multipara (at least two previous pregnancies).
- Now weighs about 300 grams or more (more than one-half pound)
- Fine hair covers body, some scalp hair is present

The sixth lunar month (24 weeks)
- The fetus now weighs about 600 grams
- Fingernails and toenails have formed
- Eyelids open to reveal completely formed eyes
- Has abundant taste buds in mouth and on tongue
- Has a grasp reflex and could support its weight by holding onto a bar with one hand
- Slight but irregular breathing and may hiccup

The seventh lunar month (28 weeks)
- About fourteen inches (35 centimeters) long and weighs about two pounds (1 kilogram)
- Has a grasp reflex and could support its weight by holding onto a bar with one hand
- Slight but irregular breathing and may hiccup

The eighth lunar month (32 weeks)
- Organism could be capable of independent life
- Usually about 16 inches (40 centimeters) long and weighs about three pounds (1½ kilograms)
- Hair on head may grow long
- Has fully developed reflex patterns and may also suck the thumb in uterus

If born at this time, the baby may be sensitive to infection and thus needs a highly sheltered environment to survive. However, the baby is able to breathe, swallow, and cry.

Infants born at this time appear small and skinny and will be high risk because they lack fat or energy reserves. Infants who weigh less than 2,500 grams (5½ pounds) represent about eight percent of all live births in the U.S. each year. There are two types of low birth weight infants: 1) those born too soon, preterm or premature and 2) those born on time but too small for their age (growth retarded or small for date). Deaths of low birth weight infants are twenty times more frequent than deaths of newborns of normal weight.

The ninth and tenth lunar months (36-40 weeks)
- Finishing touches put on the organism
- Fat forms over the body, smoothing out the contours
- Fetus may become quite active but because of increasing size, space becomes limited for movement
- Fetus may gain half a pound (¼ kilogram) a week

The fetus accumulates most of its iron during the last trimester. The fetus born prematurely has a real problem of iron deficiency because the fast expanding blood system depends on iron.

Iron deficiency may also be a problem for the pregnant woman and places her at high risk. With less hemoglobin in the blood to carry oxygen, the mother's heart works harder to get oxygen to the baby. Iron supplements may be prescribed to pregnant women because pregnancy causes great demand for iron.

The fetus acquires most of its calcium the last trimester when skeletal growth is at its greatest rate. Nails and bones are beginning to harden and teeth are being formed. At birth the infant has accumulated approximately 25 grams (or 25,000 milligrams) of calcium. Because of this high calcium requirement, three instead of two milk foods (and frequently calcium supplements) are recommended in the second and third trimester. The folk belief of "a tooth for every child" is not true since calcium in teeth is relatively stable. Mothers who lose teeth are more likely to have a history of poor eating habits and poor care of teeth.

Weight Gain

The mother should gain about 2 to 4 pounds (1 to 2 kilograms) by the end of the first trimester. The mother
will gain about one pound (a half kilogram) each week thereafter. By the end of her pregnancy this will be about a 25 pound weight gain. About two-thirds of the weight gain (16 pounds) comprise the weight of the fetus, the placenta, the amniotic fluid, and the growth of the uterus and breasts.

The pregnant woman does not require great quantities of additional food but the quality must be high. Mothers do not need to eat for two. If they do, weight gain may be too high and lead to complications. About 200 additional calories per day are needed by the pregnant woman.

Vitamins have an important role in the development of the fetus. Vitamins A, C and E have specific functions in building and maintaining cells. Vitamin A helps maintain tissues in the skin, in membranes that line glandless ducts, and in the gastrointestinal (GI), urinary and respiratory tracts. Vitamin C works with protein to form the framework in connective tissue, skin, tendons and bones. Vitamin E helps prevent the breaking of cell membrane structures and also protects vitamin A in the GI tract so more dietary vitamin A can be absorbed. In humans, vitamin E has not shown any relationship with successful reproduction.

Excessive amounts of vitamin A and D (two fat soluble vitamins) in the mother’s diet can be harmful to both the mother and the infant. Although toxic amounts of water soluble vitamins can be excreted by the mother and the fetus, excessive amounts compete for transport carriers thereby limiting the absorption of other necessary nutrients.

Vitamin and mineral supplements may be necessary for some mothers, but supplements do not contain all the nutrients needed for growth and health of the mother and the baby. Most vitamin supplements contain one to fifteen nutrients, and people need more than 40 nutrients.

Nutrients work together. Nutritional shortages during the last trimester are especially harmful to the fetus who is growing so rapidly.

Who will have the best chance of carrying the fetus to term?

1. Mothers between 20 and 29 years of age. There is a greater risk for women under 17 and over 35.

2. Mothers with health care: fetal and neonatal mortality rates are 2 to 3 times higher for those without health care.

3. Less than five previous pregnancies. One study reported that infants who ranked sixth or more in birth order had the highest mortality.

4. Good nutritional and dietary status. Pregnant women with poor food habits tend to have more complications than well-nourished mothers. Emotional stresses can also complicate dietary needs.

Good nutritional status at the time of conception is vitally important to a successful pregnancy. Don’t wait until after pregnancy begins to start nutritious patterns of food selection. Follow the Basic Four plan for pregnancy to provide the necessary nutrients.

- 3 servings of milk
- 4 servings of fruits and vegetables
- 4 servings of bread and cereal
- 2 to 3 servings of meat and meat alternates

Well-balanced foods and medical care will help ensure a healthy, happy baby.

References