HUMAN DEVELOPMENT BEFORE BIRTH

Pregnancy begins at conception with the union of a man's sperm and a woman's egg to form a single-cell embryo. This brand new being contains the original copy of a new individual's complete genetic code. Gender, eye color, and other traits are determined at conception.

Most significant developmental milestones occur long before birth during the first eight weeks following conception when most body parts and all body systems appear and begin to function.

The main divisions of the body, such as the head, chest, abdomen and pelvis, and arms and legs are established by about four weeks after conception. Eight weeks after conception, except for the small size, the developing human's overall appearance and many internal structures closely resemble the newborn.

Pregnancy is not just a time for growing all the parts of the body. It is also a time of preparation for survival after birth. Many common daily activities seen in children and adults begin in the womb—starting more than 30 weeks *before* birth. These activities include hiccups, touching the face, breathing motions, urination, right- or left-handedness, thumb sucking, swallowing, yawning, jaw movement, reflexes, REM sleep, hearing, taste, sensation, and so on.

Unless otherwise noted, all prenatal ages in the rest of this guide are referenced from the start of the last normal menstrual period. This age is two weeks greater than the age since conception.

The First Two Weeks

Shortly after a woman's period begins, her body begins preparing for the possibility of pregnancy.

Approximately 2 weeks into her cycle, a woman releases an egg from one of her ovaries into a Fallopian tube. Conception is now possible for the next 24 hours or so and signifies the beginning of pregnancy.

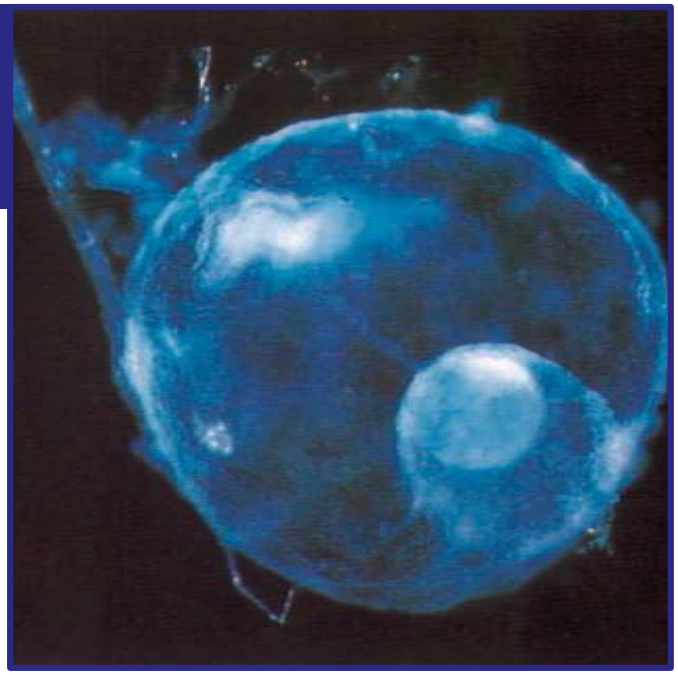
After conception, the single-cell embryo has a diameter of approximately 4 thousandths of an inch.

2 to 4 Weeks

The cells of the embryo repeatedly divide moving through the Fallopian tube into

the woman's uterus or womb. Implantation, the process whereby the unborn child embeds itself into the wall of the womb, begins by the end of the third week and is completed during the fourth week of pregnancy.

4 to 6 Weeks



At 4 weeks, the unborn child is less than 1/100th of an inch long.

By 5 weeks, development of the brain, spinal cord, and heart is well underway.

The heart begins beating at 5 weeks and one day and is visible by ultrasound almost immediately.

6 to 8 Weeks

By 6 weeks, the heart is pumping the unborn child's own blood to his or her brain and body.

All four chambers of the heart are present, and more than 1 million heartbeats have occurred.

The head, chest, and abdominal cavities have formed and the beginnings of the arms and legs are easily seen.

At 6 weeks, the unborn child measures less than ¼ of an inch long from head to rump.

Rapid brain development continues with the appearance of the cerebral hemispheres at 6½ weeks.

The unborn child reflexively turns away in response to light touch on the face at 7½ weeks.

Fingers are beginning to form on the hand.

8 to 10 Weeks

The unborn child is about ½ inch from head to rump.

By 8½ weeks, bones of the jaw and collarbone begin to harden.

Brainwaves have been measured and recorded before 8½ weeks.

By 9 weeks, the hands move, the neck turns, and hiccups begin.

Girls now have ovaries and boys have testes.

The unborn child's heart rate peaks at about 170 beats per minute and will gradually slow down until birth.

Electrical recordings of the heart at 9½ weeks are very similar to the EKG tracing of the newborn. The heart is nearly fully formed.

10 to 12 Weeks

By 10 weeks intermittent breathing motions begin, and kidneys begin to produce and release urine. All fingers and toes are free and fully formed, and several hundred muscles are present.

The hands and feet move frequently, and most unborn children show first signs of right- or left-handedness.

Pain receptors in the skin, the sensory nerves connecting them to the spinal cord, and the nerve tracts in the spinal cord that will carry pain impulses to the brain are all present by 10 weeks.

Experts estimate the 10-week unborn child possesses approximately 90% of the 4,500 body parts found in adults. This means approximately 4,000 permanent body parts are present just eight weeks after conception. Incredibly, this highly complex unborn child weighs about 1/10th of an ounce and measures slightly less than 1¼ inches from head to rump.

The eyelids are temporarily fused together by 10½ weeks.

By 11 weeks the head moves forward and back, the jaw actively opens and closes, and the unborn child periodically sighs and stretches. The face, palms of the hands, and soles of the feet are sensitive to light touch.

Thumb sucking and swallowing amniotic fluid begin.

Girls' ovaries now contain reproductive cells that will give rise to eggs later in life. Also in girls, the uterus is now present.

Yawning begins at 11½ weeks.

12 to 14 Weeks

The 12-week unborn child weighs less than 1 ounce and measures about 3 inches from head to heel.

Fingerprints start forming while fingernails and toenails begin to grow.

The bones are hardening in many locations.

The heartbeat can be detected with a Doppler (a hand-held ultrasound transducer used to detect the sounds of an unborn child's heart) or external heart rate monitor.

By 13 weeks the lips and nose are fully formed and the unborn child can make complex facial expressions.

14 to 16 Weeks

At 14 weeks, the unborn child weighs about 2 ounces and measures slightly less than 5 inches from head to heel.

Taste buds are present all over the mouth and tongue.

The unborn child now produces a wide variety of hormones.

Arms reach final proportion to body size.

By 15 weeks the entire unborn child (except for parts of the scalp) responds to light touch. Tooth development is underway.

16 to 18 Weeks

At 16 weeks, the unborn child weighs about 4 ounces and measures slightly less than 7 inches from head to heel.

A pregnant woman may begin to feel the unborn child move at 16 weeks.

The unborn child begins making several digestive enzymes.

Around 17 weeks blood cell formation moves to its permanent location inside the bone marrow and the unborn child begins storing energy in the form of body fat.

18 to 20 Weeks

By 18 weeks formation of the breathing passages, called the bronchial tree, is complete. The unborn child releases stress hormones in response to being poked with a needle.

At 18 weeks, the unborn child weighs around 6 ounces and measures about 8 inches from head to heel.

By 19 weeks, the heart has beaten more than 20 million times.

20 to 22 Weeks

By 20 weeks nearly all organs and structures have been formed.

The 20-week unborn child weighs about 9 ounces and measures about 10 inches from head to heel.

The larynx or voice box moves in a way similar to movement seen during crying after birth.

The skin has developed sweat glands and is covered by a greasy white substance doctors call “vernix,” which protects the skin from the long exposure to amniotic fluid.

At 21 weeks breathing patterns, body movements and heart rate begin to follow daily cycles called circadian rhythms.

22 to 24 Weeks

By 22 weeks hearing and response to various sounds begin as the cochlea, the organ of hearing, reaches adult size. All skin layers and structures are complete.

The unborn child reacts to stimuli that would be recognized as painful if applied to an adult human.

The 22-week unborn child weighs just less than 1 pound and measures about 11

inches from head to heel.

With specialized medical care some infants born by 22 weeks can live outside the womb with survival rates reported as high as 40% in some medical centers.

Between 20 and 23 weeks rapid eye movements begin, which are similar to the "REM sleep" pattern seen when children and adults have dreams.

24 to 26 Weeks

At 24 weeks, the unborn child is about 12 inches from head to heel and weighs about 1¼ pounds.

Survival rates for infants born at 24 weeks are reported as high as 81 percent.

By 24 weeks more than 30 million heartbeats have been performed.

By 25 weeks, breathing motions may occur up to 44 times per minute.

26 to 28 Weeks

The 26-week unborn child weighs almost 2 pounds and measures about 14 inches from head to heel.

By 26 weeks sudden, loud noises trigger a blink-startle response and may increase movement, heart rate, and swallowing.

The lungs produce a substance necessary

for breathing after birth.

The survival rate of infants born at 26 weeks is reported as high as 95 percent.

By 27 weeks the thigh bone and the foot bones are each about two inches long (about 5 cm).

28 to 30 Weeks

By 28 weeks the sense of smell is functioning and eyes produce tears.

The 28-week unborn child weighs more than 2½ pounds and measures about 15 inches from head to heel.

Nearly all infants born between this point and full term survive.

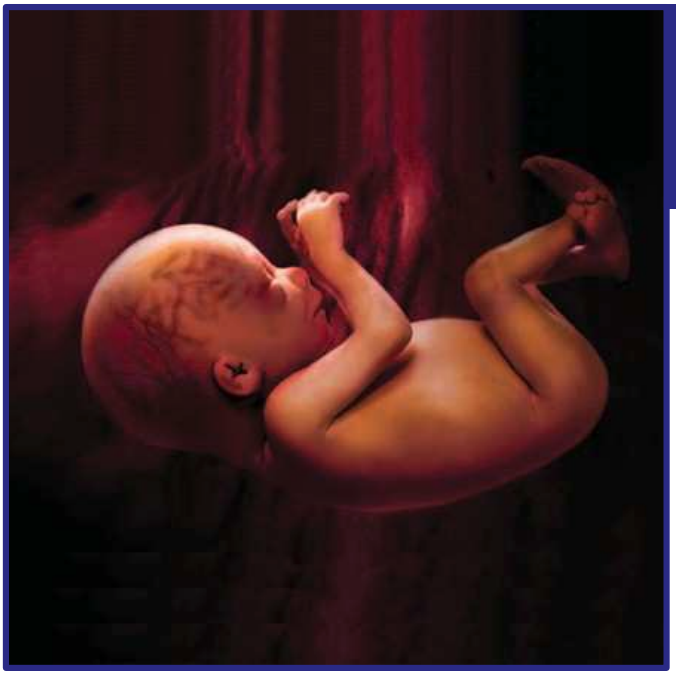
By 29 weeks, pupils of the eyes react to light.

30 to 32 Weeks

At 30 weeks, the unborn child weighs about 3¼ pounds and measures about 16 inches from head to heel.

By 31 weeks the heart has beat more than 40 million times.

Wrinkles in the skin are disappearing as more and more fat deposits are formed.



32 to 34 Weeks

By 32 weeks breathing movements occur up to 40 percent of the time.

The 32-week unborn child weighs about 4 pounds and measures about 17 inches from head to heel.

34 to 36 Weeks

By 34 weeks true alveoli (al-vē'ō-lī), or air "pocket" cells, begin developing in the lungs.

The 34-week unborn child weighs about 5 pounds and measures about 18 inches from head to heel.

36 to 38 Weeks

At 36 weeks, the unborn child weighs about 5¾ pounds and measures about 18½ inches from head to heel.

Scalp hair is silky and lies against the head.

By 37 weeks the unborn child has a firm hand grip, and the heart has beat more than 50 million times.

38 to 40 Weeks

The 38-week unborn child weighs about 6¾ pounds and measures about 19 inches from head to heel.

At term, the umbilical cord is typically 20 to 24 inches long.

The unborn child initiates labor, ideally around 40 weeks, leading to childbirth.

At full term, newborn babies typically weigh between 6 and 9 pounds and measure between 18 and 21 inches from head to heel.