Human Growth and Reproduction
Sperm reach ovum and cluster around it
Only one sperm is allowed to penetrate egg
When the sperm penetrates the egg, the egg immediately releases a chemical creating a hard “shell” around it to keep all other sperm out.
2 cell zygote

The zygote begins to develop

4 cell zygote
Blastocyst – When zygote divides to 32 cells it becomes known as a Blastocyst.
Cross Section of a Blastocyst
The Blastocyst embeds into the uterine lining, and begins to develop the placenta.
The placenta is the lining of the uterus that the umbilical cord will attach to.

While nutrients and oxygen move across the placental wall, the embryo’s blood and the mother’s blood never mix.
Day 15
The primitive streak can be seen on the left side of this embryo.

Day 17
The primitive streak can still be seen, and the opposite end of the embryo is starting to fold up.

The Blastocyst begins to collapse
Day 19

The neural tube is seen along with somites on either side of it.

Somites - zipper-like motion of the neural tube closing together, three pairs of small bumps form on either side of the closure. They will form the skeleton and the major muscles of the body. Thirty-eight pairs of somites will line the neural tube within 2 weeks.
5 Week Embryo

5 Week, 4 day Embryo
At the end of four weeks:

Embryo is 1/4 inch in length

Heart, digestive system, backbone and spinal cord begin to form

Placenta (sometimes called "afterbirth") begins developing

The single fertilized egg is now 10,000 times larger than size at conception
At the end of 8 weeks:

Embryo is 1 1/8 inches in length

Eyes, nose, lips, tongue, ears and teeth are forming

Penis begins to appear in boys

Embryo is moving, although the mother can not yet feel movement

Heart is functioning
At the end of 12 weeks:

Fetus is 2 1/2 to 3 inches long

Weight is about 1/2 to 1 ounce

Nails start to develop and earlobes are formed

Fetus develops recognizable form

Arms, hands, fingers, legs, feet and toes are fully formed

Eyes are almost fully developed

By this stage, a fetus has developed most of his/her organs and tissues

Fetal heart rate can be heard at 10 weeks with a special Doppler instrument
At the end of 4 months:
Fetus is 6 1/2 to 7 inches long

Weight is about 6 to 7 ounces

Fetus is developing reflexes such as sucking and swallowing. Fetus may begin sucking his/her thumb

Tooth buds are developing

Sweat glands are forming on palms and soles

Fingers and toes are well defined

Sex is identifiable

Skin is bright pink, transparent and covered with soft, downy hair

Although recognizably human in appearance, the baby would not be able to survive outside the mother's body
At the end of 5 months:

Fetus is 8 to 10 inches long

Weight is about 1 pound

Hair begins to grow on his/her head

Soft woolly hair called lanugo will cover its body (and some may remain until a week after birth when it is shed)

Mother begins to feel fetal movement

Internal organs are maturing

Eyebrows, eyelids and eyelashes appear
At the end of 6 months:
Fetus is 11 to 14 inches long

Weight is about 1 3/4 to 2 pounds

Eyelids begin to part and eyes open occasionally for short periods of time

Skin is covered with protective coating called vernix

Fetus is able to hiccup
At the end of 7 months:
Fetus is 14 to 16 inches long

Weight is about 2 1/2 to 3 1/2 pounds

Taste buds have developed

Fat layers are forming

Organs are maturing

Skin is still wrinkled and red

If born at this time, he/she will be considered a premature baby and require special care
At the end of 8 months:
Fetus is 16 1/2 to 18 inches long

Weight is about 4 to 6 pounds

Overall growth is rapid this month

Tremendous brain growth occurs at this time

Most body organs are now developed with the exception of the lungs

Movements or "kicks" are strong enough to be visible from the outside

Kidneys are mature

Skin is less wrinkled

Fingernails now extend beyond fingertips
At the end of 9 months:
Fetus is 19 to 20 inches long

Weight is about 7 to 7 ½ pounds

The lungs are mature

Baby is now fully developed and can survive outside the mother's body

Skin is pink and smooth

He/she settles down lower in the abdomen in preparation for birth and may seem less active
Fetal Development

• Objectives:
  • Understand the growth of a human fetus.
  • Follow the development from conception to birth.
  • Introduction to the birth process.

Photo and Text Courtesy of Georgia Department of Human Resources, Division of Public Health.
Conception

Conception means a woman's egg has been fertilized by a man's sperm. Within a day, the egg begins to divide and develop rapidly. A few days later a cluster of cells arrives in the uterus. By the eighth day after conception, this cluster has increased to hundreds of cells and attaches to the wall of the uterus where it continues its rapid growth.
Four Weeks

After the cluster of cells attaches to the womb it is called an embryo. The embryo is between 1/100 and 4/100 inch long at this time. The embryo continues rapid growth.
6 Weeks

The embryo is about ¼ inch long and has developed a head and a trunk. Structures that will become arms and legs, called limb buds, first appear. A blood vessel forms and begins to pump blood. This will develop into the heart and circulatory system. At this time, a ridge of tissue forms down the back of the embryo. That tissue will develop into the brain and spinal cord.
* 8 Weeks
  • The embryo is about ½ inch long.
  • The heart now has four chambers.
  • Fingers and toes begin to form.
  • Reflex activities begin as the brain and nervous system develop.
  • Cells begin to form the eyes, ears, jaws, lungs, stomach, intestines and liver.
10 Weeks

The embryo, is about 1 to 1¼ inches long (the head is about half the length) and weighs less than ½ ounce. The beginnings of all key body parts are present, but they are not completed. Structures that will form eyes, ears, arms and legs can be seen. Muscles and skeleton are developing and the nervous system becomes more responsive.
12 Weeks

The fetus is about 2½ inches long and weighs about ½ ounce. Fingers and toes are distinct and have nails. Hair begins to develop, but won't be seen until later in the pregnancy. The fetus begins small, random movements, too slight to be felt. The fetal heartbeat can be detected with a heart monitor. All major external body features have appeared. Muscles continue to develop.
14 Weeks

The fetus is about 3½ inches long and weighs about 1½ ounces. The fetus begins to swallow, the kidneys make urine, and blood begins to form in the bone marrow. Joints and muscles allow full body movement. There are eyelids and the nose is developing a bridge. External genitals are developing.
16 Weeks

The fetus is about 4½ inches long and weighs about 4 ounces. The head is erect and the arms and legs are developed. The skin appears transparent. A fine layer of hair has begun to grow on the head. Limb movements become more coordinated.
18 Weeks

The fetus is about 5½ inches long and weighs about 7 ounces. The skin is pink and transparent and the ears are clearly visible. All the body and facial features are now recognizable. The fetus can grasp and move its mouth. Nails begin to grow. The fetus has begun to kick. Some women feel this movement.
20 Weeks
The fetus is about 6¼ inches long and weighs about 11½ ounces. All organs and structures are formed.
Skin is wrinkled and pink to reddish in color - thin and close to the blood vessels. Protective skin coating, (vernix) begins to develop. Respiratory movements occur - lungs have not developed enough to permit survival outside the uterus. By this time, mothers usually feel the fetus moving. At this time an ultrasound can often identify the sex of the fetus.
22 Weeks

The fetus is about 7½ inches long weighs about one pound. It has fingerprints and some head and body hair. It may suck its thumb and is more active. The brain is growing very rapidly. The fetal heartbeat can be easily heard. The kidneys start to work. At 23 weeks, approximately 31% of babies born survive. Babies born at this age require intensive care and usually have lifelong disabilities and chronic health conditions.
24 Weeks
The fetus is about 8¼ inches long and weighs about 1¼ pounds. Bones of the ears harden making sound conduction possible. The fetus hears mother’s sounds such as breathing, heartbeat and voice. The first layers of fat are beginning to form. This is the beginning of substantial weight gain for the fetus. Lungs continue developing.

At 25 weeks, approximately 68% of babies born survive. Babies born at this age require intensive care and usually have life-long disabilities and chronic health conditions.
26 Weeks
The fetus is about 9 inches long and weighs about 2 pounds. The fetus can respond to sound from both inside and outside the womb. Reflex movements continue to develop and body movements are stronger. Lungs continue to develop. The fetus now wakes and sleeps. The skin is slightly wrinkled.

At 27 weeks, approximately 87% of babies born survive. Babies born at this age require intensive care and have an increased risk of developmental delays and chronic health conditions.
28 Weeks
The fetus is about 10 inches long and weighs about 2 pounds, 3 ounces. Mouth and lips show more sensitivity. The eyes are partially open and can perceive light. More than 90% of babies born at this age will survive. Some survivors have developmental delays and chronic health conditions.
30 Weeks
The fetus is about 10½ inches long and weighs about 3 pounds. The lungs that are capable of breathing air, although medical help may be needed. The fetus can open and close its eyes, suck its thumb, cry and respond to sound. The skin is smooth. Rhythmic breathing and body temperature are now controlled by the brain. Most babies born at this age will survive.
32 Weeks
The fetus is about 11 inches long and weighs about 3 pounds, 12 ounces. The connections between the nerve cells in the brain increase. Fetal development now centers on growth. Almost all babies born at this age will survive.
34 Weeks
The fetus is about 12 inches long and weighs about 4½ pounds.
Ears begin to hold shape.
Eyes open during alert times and close during sleep.
Almost all babies born at this age will survive.
36 Weeks
The fetus is about 12 to 13 inches long and weighs about 5½ to 6 pounds. Scalp hair is silky and lies against the head. Muscle tone has developed and the fetus can turn and lift its head. Almost all babies born at this age will survive.
38 Weeks
The fetus is about 13½ to 14 inches long and weighs about 6½ pounds. Lungs are usually mature. The fetus can grasp firmly. The fetus turns toward light sources. Almost all babies born at this age will survive.
40 Weeks
The fetus is about 18 to 20 inches long and may weigh about 7½ pounds. At the time of birth, a baby has more than 70 reflex behaviors, which are automatic behaviors necessary for survival. The baby is full-term and ready to be born.

Photo and Text
Courtesy of
Georgia Department of Human Resources,
Division of Public Health
CRITICAL PERIODS IN HUMAN DEVELOPMENT*

- period of dividing zygote, implantation & bilaminar embryo
- eye, heart, limbs
- common site of action of teratogen
- palate, ear, external genitalia
- brain, central nervous system
- not susceptible to teratogens

1. prenatal death
2. major congenital anomalies (red)
3. functional defects & minor congenital anomalies (yellow)

* Red indicates highly sensitive periods when teratogens may induce major anomalies.
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<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td>3</td>
<td>First missed menstrual period</td>
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<td>4</td>
<td>Neural folds fusing. Neural folds fusing.</td>
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<td>Heart begins to beat. Heart begins to beat.</td>
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**Key Terms:**
- Neural fold
- Neural groove
- Somite
- Embryonic cecum
- Notochord
- Primitive streak
- Trilaminar embryo
- Heart tube
- Second arches
- Developing eye
- Hand plate
- Nasal pit
- Optic cup
- Hand plate
- Foot plate
- Upper lip formed
- Digital rays
- Auricular hillocks
- Ventral view
- C.R. (Crown-Rump Length)

**Measurements:**
- 1.5 mm
- 4.0 mm
- 5.0 mm
- 7.0 mm
- 8.0 mm
- 9.0 mm
- 10.0 mm
- 13.0 mm
TIMETABLE OF HUMAN PRENATAL DEVELOPMENT
7 to 38 weeks

AGE

43  Tip of nose distinct.

44  Stage 18 begins

45  Digital rays appear in foot plates.

46  Loss of villi Smooth chorion forms.

47  Genital tubercle

48  Stage 19 begins

49  Urogenital membrane

R  anal membrane

50  Trunk elongating and straightening.

51  Upper limbs longer & bent at elbows.

52  Anal membrane perforated Urogenital membrane degenerating.

53  Stage 21 begins

54  External genitalia still in sexless state but have begun to differentiate.

55  Stage 22 begins

56  Genital tubercle urethral groove anus

57  Beginnings of all essential external & internal structures are present.

58  Beginning of fetal period.

59  Genitalia show some ♀ characteristics but still easily confused with ♂.

60  Phallus urogenital fold labioscrotal fold perineum

61  Genitalia show fusion of urethral folds. Urethral groove extends into phallus.

62  Phallus urogenital fold labioscrotal fold perineum

63  Stage 23

64  Face has human profile.

65  Note growth of chin compared to day 44.

66  Face has human appearance.

67  Labium minus urogenital groove labium major

68  Genitalia have ♀ or ♂ characteristics but still not fully formed.

69  Glans penis urethral groove scrotum

70  CR: 61 mm

C.R.: 16.0 mm

C.R.: 17.0 mm

C.R.: 18 mm

C.R.: 30 mm

C.R.: 50 mm

C.R.: 61 mm