

# Stages of Prenatal Development

By

Kendra Cherry

Medically reviewed by

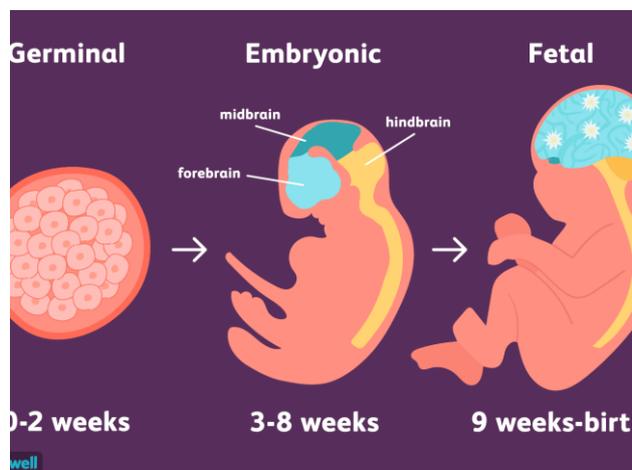
Steven Gans, MD

Updated on September 29, 2019

<https://www.verywellmind.com/stages-of-prenatal-development-2795073>

Prenatal period is an important part of child development - it sets the stage for future psychological development. The brain develops over the course of the prenatal period, but it will continue to go through more changes during the early years of childhood.

3 Major stages of prenatal development:



1. Weeks 0-2 – germinal
2. Weeks 3-8 – embryonic
3. Weeks 9-40 - fetal

## Germinal Stage

The germinal stage begins at conception when the sperm and egg cell unite in one of the two fallopian tubes. The fertilized egg, known as a **zygote**, then moves toward the uterus, a journey that can take up to a week to complete. Cell division (mitosis) begins approximately 24 to 36 hours after conception. A significant number of zygotes never progress past this early part of cell division, with as many as half of all zygote's surviving less than two weeks.

Once the eight-cell point has been reached, the cells begin to differentiate and take on certain characteristics that will determine the type of cells they will eventually become. Also: As the cells multiply, they separate into two distinctive masses: the outer cells will eventually become the placenta while the inner cells will form the embryo.

Cell division continues at a rapid rate and the cells then develop into a **blastocyst**. The blastocyst is made up of three layers<sup>1</sup> :

1. The **ectoderm** (which will become the skin and nervous system)
2. The **endoderm** (which will become the digestive and respiratory systems)

3. The **mesoderm** (which will become the muscle and skeletal systems).

Finally, the blastocyst arrives at the uterus and attached to the uterine wall, a process known as implantation.

Researchers estimate that approximately 60% of all natural conceptions never become properly implanted in the uterus, which results in the new life ending before the mother is ever aware she is pregnant.

When implantation is successful, hormonal changes halt a woman's normal menstrual cycle and cause a whole host of physical changes. For some women, activities they previously enjoyed such as smoking and drinking alcohol or coffee may become less palatable, possibly part of nature's way of protecting the growing life inside her<sup>2</sup>.

## Embryonic Stage

At this point, the mass of cells is now known as an embryo. The beginning of the third week after conception marks the start of the embryonic period, a time when the mass of cells becomes distinct as a human. The embryonic stage plays an important role in the development of the brain.

The embryo begins to divide into three layers each of which will become an important body system. Approximately four weeks after conception, the neural tube forms. This tube will later develop into the central nervous system including the spinal cord and brain.

The neural tube begins to form along with an area known as the neural plate. The earliest signs of development of the neural tube are the emergence of two ridges that form along each side of the neural plate. Over the next few days, more ridges form and fold inward until a hollow tube is formed. Once this tube is fully formed, the cells begin to form near the center.<sup>3</sup> The tube begins to close and brain vesicles form. These vesicles will eventually develop into parts of the brain including the structures of the forebrain, midbrain, and hindbrain.

Around the fourth week, the head begins to form quickly followed by the eyes, nose, ears, and mouth. The cardiovascular system is where the earliest activity begins as the blood vessel that will become the heart start to pulse.

During the fifth week, buds that will form the arms and legs appear.

By the time the eighth week of development has been reached, the embryo has all of the basic organs and parts except those of the sex organs. It even has knees and elbows! At this point, the embryo weighs just one gram and is about one inch in length.

By the end of the embryonic period, the basic structures of the brain and central nervous system have been established. At this point in development, the basic structure of the central and peripheral nervous system are also defined.

Research has shown that the production of neurons begins around day 42 after conception and is mostly complete sometime around the middle of pregnancy.

As neurons form, they migrate to different areas of the brain. Once they have reached the correct location, they begin to form connections with other neural cells, establishing rudimentary neural networks.

## Fetal Stage

Once cell differentiation is mostly complete, the embryo enters the next stage and becomes known as a fetus. The fetal period of prenatal development marks more important changes in the brain. This period of development begins during the ninth week and lasts until birth.

The early body systems and structures established in the embryonic stage continue to develop. It is at this point in prenatal development that the neural tube develops into the brain and spinal cord and neurons continue to form. Once these neurons have formed, they begin to migrate to their correct locations. Synapses, or the connections between neurons, also begin to develop.

It is during the period between the 9th and 12th week at the earliest reflexes begin to emerge and the fetus begins to make reflexive motions with his arms and legs.<sup>4</sup>

This stage of prenatal development lasts the longest and is marked by amazing change and growth. During the third month of gestation, the sex organs begin to differentiate and by the end of the month, all parts of the body will be formed. At this point, the fetus weighs around three ounces. The fetus continues to grow in both weight and length, although the majority of the physical growth occurs in the later stages of pregnancy.

The end of the third month also marks the end of the first trimester of pregnancy. During the second trimester or months four through six, the heartbeat grows stronger and other body systems become further developed. Fingernails, hair, eyelashes, and toenails form<sup>5</sup>. Perhaps most noticeably, the fetus increases quite dramatically in size, increasing about six times in size.

So what's going on inside the brain during this important period of prenatal development? The brain and central nervous system also become more responsive during the second trimester. Around 28 weeks, the brain starts to mature faster with an activity that greatly resembles that of a sleeping newborn.

During the period from seven months until birth, the fetus continues to develop, put on weight, and prepare for life outside the womb. The lungs begin to expand and contract, preparing the muscles for breathing.

## A Word From Verywell

The prenatal period of development is a time of physical growth, but what's going on inside the brain is critical for future psychological development. The brain development that takes place during the prenatal period helps set the course for what will take place outside the womb.

While prenatal development usually follows this normal pattern, there are times when problems or deviations occur. Learn more about some of the [problems with prenatal development](#). Disease, malnutrition, and [other prenatal influences](#) can have a powerful impact on how the brain develops during this critical period.

But brain development does not end at birth. There is a considerable amount of brain development that takes place postnatally including growing in size and volume while changing in structure. The brain grows by about four times the size between birth and preschool. As children learn and have new experiences, some networks in the brain are strengthened while other connections are pruned.

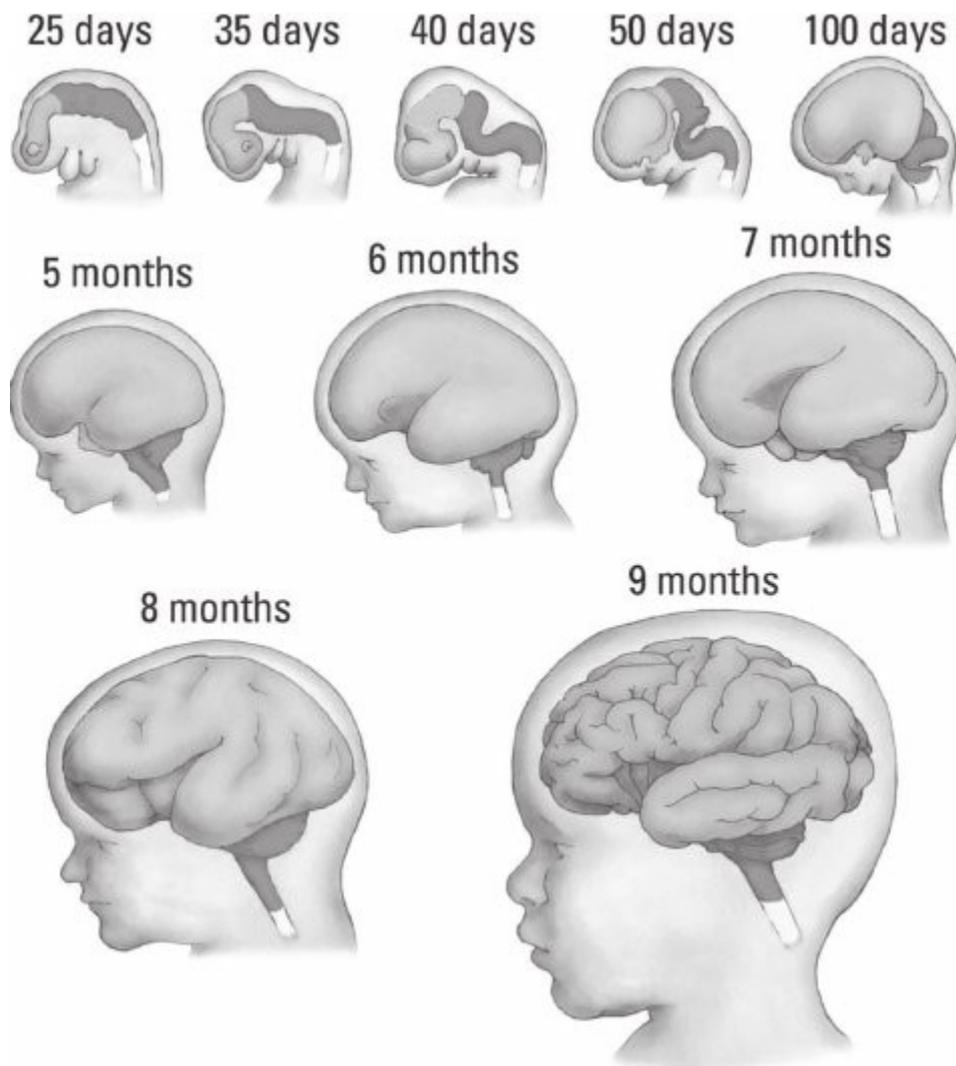


FIGURE 2. Prenatal development of the human brain showing a series of embryonic and fetal stages. (Adapted from Cowan, 1979.)

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# Brain Fissure Development

Sylvian fissure

Calcarine fissure

Parieto-occipital sulcus

