

[In the Womb \(2005\), by Toby Mcdonald and National Geographic Channel](#) ^[1]

By: Maayan, Inbar Keywords: [Human development](#) ^[2] [Movies](#) ^[3] [Fetus](#) ^[4]

Written, produced, and directed by Toby Mcdonald, the 2005 National Geographic Channel film *In the Womb* uses the most recent technology to provide an intricate glimpse into the prenatal world. The technologies used, which include advanced photography, computer graphics, and 4-D [ultrasound](#) ^[5] imaging, help to realistically illustrate the process of development and to answer questions about the rarely seen development of a human being. The following description of the images and narrative of the film captures the major points of *In the Womb*, and of embryonic and fetal development, as they are seen at the outset of the twenty-first century, depicted in only 100 minutes.

In the Womb opens with a glimpse of the mature [fetus](#) ^[6] moments before she is ready to emerge into the outside world. The narrator explains that at this final stage, she is equipped with all of the faculties necessary for full function outside the [womb](#) ^[7]. The main focus of the film, however, is the journey leading up to these final moments, a journey that begins with just a single cell. This journey is viewed intermittently throughout the film using 3-D and 4-D [ultrasound](#) ^[5] scanning techniques which show the baby moving. 4-D refers to a string of 3-D images taken in real time (time is the fourth dimension), thus creating a movie of in utero events. In addition, the process is simulated by computer imaging based on observations, giving a vivid portrayal of embryonic and fetal development.

The developmental narrative begins with millions of swimming [sperm](#) ^[8], and an explanation of their unique purpose—carrying the father’s genetic information to the moment of [conception](#) ^[9]. The [sperm](#) ^[8] are produced in a man’s [testes](#) ^[10], and their quality depends on his lifestyle choices; they tend to be damaged by the consumption of various drugs and by heat, and stimulated by the consumption of coffee. A single [sperm](#) ^[8] is filmed swimming across a black landscape, which accentuates the rapid, intricate movements of its tail. The tail’s flexibility allows the [sperm](#) ^[8] to progress approximately a tenth of an inch per minute. Millions of [sperm](#) ^[8] are filmed as they appear in the [vagina](#) ^[11], many of them dead on their sides, with the vast crowd in the middle swimming toward the [uterus](#) ^[12], the [fallopian tubes](#) ^[13], and the [egg](#) ^[14], which looks like a moon-like orb nestled among its protective agents. This [egg](#) ^[14], like all her others, was formed during the mother’s own time in the [womb](#) ^[7] and has resided in her body ever since.

The film suggests that in order to find the [egg](#) ^[14], the [sperm](#) ^[8] “sniff it out” using their figurative sense of smell. A graphical simulation shows the [sperm](#) ^[8] traveling toward the awaiting [egg](#) ^[14], and one of them penetrating its outer layer. The bigger picture, in which the rest of the [sperm](#) ^[8] are permanently shut out upon [fertilization](#) ^[15], is filmed. Another graphical simulation follows, illustrating the fusion of the father’s and the mother’s genetic material at the moment of [conception](#) ^[9]. The narrator notes that this particular genetic combination has never before existed, and will never be duplicated in another human being.

DNA, which carries the organism’s genetic information and is bundled in the chromosomes, is depicted as a long, energetic helix that carries the more than 20,000 [genes](#) ^[16] that make up an average human. These [genes](#) ^[16] are responsible for various characteristics and are determined by parental contributions. They are absolutely crucial to the development of new life. The various physical effects of genetic information are illustrated in the display of various shapes of eyes, noses, hair, and other features. The great variability of genetic effects on appearance is depicted by the morphing of a face to show a variety of characteristics, both male and female. It is noted, however, that while the parents contribute equal amounts of genetic information, it is the DNA from the [sperm](#) ^[8] that determines the child’s sex, via its twenty-third chromosome, which is either an X or a Y. The [genes](#) ^[16] contributed by the parents largely predetermine the child’s appearance and much of the child’s personality and predisposition for certain diseases.

After the illustration and explanation of [fertilization](#) ^[15], a description of the fertilized egg’s journey toward the [uterus](#) ^[12] is accompanied by film footage of the process. As it sails along the fallopian tube on the first day of its journey, the single cell divides into two identical cells. Cell division continues and by the fifth day, the resulting ball of cells is made up of about 100 cells and is called a [blastocyst](#) ^[17]. At this stage, the [blastocyst](#) ^[17] will split into two groups of cells: the outer layer prepares to become the [placenta](#) ^[18], [umbilical cord](#) ^[19] and fetal membranes, and the inner layer prepares to become the embryo itself. The cells making up the inner part of the [blastula](#) ^[20] are [stem cells](#) ^[21], and have the ability to differentiate into all of the different types of cells that make up the human body. One week after [fertilization](#) ^[15], the [blastula](#) ^[20] reaches the [uterus](#) ^[12], where it will start to develop into a new human being.

Three weeks into [gestation](#) ^[22], *In the Womb* simulates the embryo folding inward and elongating as the basic body plan is determined. An actual embryo at this stage is shown and a basic spine is visible. The top of the embryo, destined to become the

head and brain, is indicated; this region has already begun to generate [nerve cells](#) ^[23] by the fifteenth day of the [pregnancy](#) ^[24]. These [nerve cells](#) ^[23] will proliferate and eventually become the brain and the [central nervous system](#) ^[25]. The heart forms soon after this, and twenty-two days after [conception](#) ^[9], begins to beat. This movement is initiated by a single heart cell which begins to beat and induces the cells around it to beat to the same rhythm. Close-up filming shows this pulse as heart cells proliferate and the organ continues to form. With the formation of the heart come thin veins and early blood cells responsible for transporting oxygen and nutrients; the blood in these veins moves to the beat of the heart. During the early stages of development the heart beats relatively independently, though its function will later be carefully regulated by the brain.

By the time the embryo is four weeks old, preliminary eyes have appeared on her head. These look like dark spots on a pale landscape of surrounding tissue on which the early contours of the forehead, nose, mouth, and other parts of the mature face can be seen. In addition, arm and leg buds emerge. The narrator mentions that even though thirty days have passed since [conception](#) ^[9], the embryo is almost indistinguishable from the embryos of other mammals.

The changes taking place in the embryo's [morphology](#) ^[26] over the following few weeks are shown through film progression. The face plates move in to better define facial features, arms and legs continue to take shape, and the head becomes more clearly defined. At six weeks, the embryo is about an inch long, has a firmly rooted and visible [umbilical cord](#) ^[19], and the outline of her fingers can be distinguished as well. The eyes have developed by leaps and bounds, although they are not yet concealed by eyelids. The nostrils are now visible, wide-set beneath the eyes on a head that is giant in relation to the size of the body. By the end of eight weeks of [gestation](#) ^[22], the embryo is called a [fetus](#) ^[6] and is no longer dependent on the [yolk](#) ^[27] sac that nourished it during the [embryonic stage of development](#) ^[28]. The [yolk](#) ^[27] sac, a balloon-like structure of tissue with visible veins, vanishes at this point and the [fetus](#) ^[6] becomes solely dependent on the [umbilical cord](#) ^[19] rooted in the [placenta](#) ^[18], and thus on the mother's blood for nutrition. A close examination of the [placenta](#) ^[18] reveals intricate blood vessels transporting the nutrients necessary for the embryo's growth, while keeping out many of the toxins present in the mother's own blood. Despite the placenta's effectiveness, substances like drugs and alcohol cannot be completely be filtered out, and it's up to the mother to limit her consumption of them.

By nine weeks, the nervous system has developed dramatically and starts to allow the [fetus](#) ^[6] to move. Although this movement, shown through computer simulation, is not yet connected to the brain, it promotes agility and further growth. After this point, the body will gradually come under the control of the brain. This change also has the effect of regulating heart rate, which may increase to more than 150 beats per minute before cerebral [regulation](#) ^[29].

A standard [ultrasound](#) ^[5] is performed at the Create Health Clinic in London at the conclusion of the [first trimester](#) ^[30], and the narrator explains how [ultrasound](#) ^[5] waves function to create the image on the screen. While a physician explains the various tests that can be done at this stage of [pregnancy](#) ^[24] using [ultrasound](#) ^[5], the baby's heart can be seen contracting and expanding in the moving image. A step beyond standard [ultrasound](#) ^[5] is the 4-D scan, which shows the three-dimensional [fetus](#) ^[6] moving in real time. This tool allows for even more accurate evaluation of the fetus's health and development. It shows everything from the [fetus](#) ^[6] moving her arms to yawning or playing with her nose. Four-dimensional scans of various babies at different stages of development greatly expand the amount of detail that is visible to the world outside the [womb](#) ^[7]. The narrator also notes that this first [ultrasound](#) ^[5] scan is the first opportunity to ascertain the number of fetuses present in the [womb](#) ^[7].

Four-dimensional scans also allow us to see the preliminary steps of a baby's literal first steps. These are manifested in scans of eleven- and twelve-week-old fetuses kicking and pushing off the walls of the [uterus](#) ^[12] as they exercise the use of their appendages. This movement is called the stepping reflex, and it is controlled by the fetus's nervous system. The five weeks leading up to this point, weeks six through eleven, are considered to be the period in which the [fetus](#) ^[6] undergoes the most dramatic transformations in its developmental journey. By the end of the eleventh week, all organs have formed, but the [fetus](#) ^[6] is still tiny—about three inches long—and thus must grow significantly before it can be [viable](#) ^[31]. Sex is also determined at this point, and the sex organs produce [hormones](#) ^[32] that further regulate the sexual development of the [fetus](#) ^[6]. Miscarriage beyond this point is far less likely than during the first three months of [pregnancy](#) ^[24], since the [fetus](#) ^[6] is more stable.

As time goes on, the [fetus](#) ^[6] looks more and more human, and her senses sharpen further. Simulation reveals highly developed hands and the hardening ([ossification](#) ^[33]) of bones beneath the semi-transparent skin. The face looks far more “human” as well, with the eyes now closer together and the nose and mouth more defined. By this time, the brain controls most of the body—including the heart—through the [central nervous system](#) ^[25]. Aside from seeing the heart, a Doppler probe is also used to hear what the fetus' heart sounds like. It beats at a frantic 146 beats per minute, which the physician indicates is a healthy pace for a [fetus](#) ^[6] this age. At four months, she not only has control of her heart rate, but she also begins to respond to physical stimuli and to move around a lot. She has also begun to develop proprioception, which is the awareness of the body's position in its surroundings. She is shown feeling the sides of the [womb](#) ^[7] and grasping at different parts of her body. Four-dimensional images of twins also reveal how interactive they are with each other; identical twins, however, interact much more than do fraternal twins, who have a membrane separating them. This membrane is also visible with this more detailed scanning tool.

Eighteen weeks after [conception](#) ^[9], fetal movements become readily detectable to the mother. In addition, the [fetus](#) ^[6] starts digesting amniotic fluid as her digestive system begins preparation for the outside world. Another preparation has been revealed by 4-D scans, where the [fetus](#) ^[6] can be seen practicing the blinking reflex. Soon, she will even have her own fingerprints. At the

conclusion of the second [trimester](#)^[30], the [fetus](#)^[6] is fully formed but still needs to experience dramatic growth and to develop her senses. The film states that at this stage, she begins to taste flavors from her mother's food, and to hear the sounds that surround her cocoon, including the tone and cadence of her mother's voice. Comfort with her mother's various sense-inducing habits may even prove conducive to more healthy development once the baby has been born.

In the Womb also notes that, as well as providing a preliminary basis for diagnosis of complications, [ultrasound](#)^[5] scans also promote the development of parental attachment to the yet-[unborn child](#)^[34]. Ultrasound is thought to enhance the relationship of the child with the parents, both in infancy and later in life. At twenty-four weeks, this relationship could begin prematurely, for it is at this point that a baby could survive outside of the [womb](#)^[7]; though still small and underdeveloped, with appropriate intensive care, she could be considered [viable](#)^[31]. The greatest complications may arise due to the premature lungs, since the lungs only fully develop near the conclusion of the [pregnancy](#)^[24] and are filled with amniotic fluid until breathing begins.

The eyes, which have been fully developed since the middle of the [pregnancy](#)^[24], cannot see yet but are adorned with eyelashes by the twenty-fifth week. Babies are usually born with lighter-colored eyes than they will have later; babies of Caucasian descent are often born with blue eyes, while babies of Asian or African descent first have darker brown eyes. These colors will often change or deepen during the first few months of life, as the pigments in the eyes are exposed to light, which is absent in the [womb](#)^[7]. In the darkness of the [womb](#)^[7], babies in their final [trimester](#)^[30] spend most of their time sleeping soundly. When they are awake, however, fetuses are often active, practicing their reflexes in response to provocations from outside the [womb](#)^[7]. These include the startle reflex, when the [fetus](#)^[6] flings her arms out and over her head, and the swallowing and sucking process, crucial to nutrition outside of the [womb](#)^[7]. The latter may be manifested in thumb sucking, which is thought to be strongly correlated with handedness during a person's life.

The [placenta](#)^[18] not only conducts oxygen, nutrients, and flavors to the [fetus](#)^[6], but it may also conduct the mother's mood. The fear or anxiety that a mother might experience cascade through, eventually causing the baby's heart to beat faster as well. Serious and sustained stress or anxiety have been found to result in stress in the child and a higher risk for stress-related physical and mental health complications. Past twenty-six weeks the [fetus](#)^[6] concentrates almost solely on growth; despite this, serious issues might arise even before birth. *In the Womb* shows Dr. Kypros Nicolaides of King's College Hospital in London diagnosing and performing *in utero* surgery on a [fetus](#)^[6] whose intestines are obstructing lung growth. He performs this delicate surgery with the help of a fetoscope, which allows him to see inside the [womb](#)^[7] and is also used as a tool in the surgery itself. Nicolaides' technique for treating this particular disorder has been met with a 50% increase in the survival rate of his prenatal patients.

The last two months of [pregnancy](#)^[24] see the final steps toward a healthy birth. During this time, the [fetus](#)^[6] develops a layer of insulating fat and has even been found to develop consciousness and memory. The [fetus](#)^[6] may remember and respond to familiar sounds such as her mother's voice or even her parents' favorite music. If the [fetus](#)^[6] recognizes music, she might even move in rhythm. Fast music has been found to stimulate and excite the [fetus](#)^[6], which seems to be almost dancing in the [womb](#)^[7], while classical music will often have a calming effect. The development of all of these complex functions prior to birth has also led some experts to posit that, developmentally, birth is not as significant as was previously assumed. This is because the brain of a maturing [fetus](#)^[6] is almost identical to that of a newborn. This similarity is particularly striking considering the sighting of rapid eye movement (REM) in 4-D scans, since these are indicative of dreaming. From thirty-five weeks on, the [fetus](#)^[6] could be fully functional and self-supporting (aside from its need for external nutrition and warmth).

The film notes that though it is not yet certain what sets off delivery, the maturation of the lungs may play a key role. When mature, the lungs release a protein that affects the [hormone](#)^[35] production of the [placenta](#)^[18], reducing [progesterone](#)^[36] production and initiating the production of oxytocin, which in turn triggers uterine contractions and inhibition of memory. These are useful when the [cervix](#)^[37] undergoes extreme widening—approximately 10 cm—as it conveys the baby's large head out into the world.

In the Womb has now gone full-circle, arriving again at the time of delivery. To ease the pain of delivery and risks of complication, the mother in the movie delivers standing up and leaning forward with her legs spread apart slightly. During this time, the baby releases large quantities of adrenalin, which keeps the heart pumping fast and prepares the lungs to take their first breathes of air. Soon, the baby's head crowns and is followed by the rest of the body. As soon as the baby has emerged, it starts crying as its lungs fill with oxygen and it is exposed to the light and cold of the outside world. The [placenta](#)^[18], now unnecessary, detaches from the [uterus](#)^[12] and exits the mother's body through the birth canal. *In the Womb* reviews the entire process of the [pregnancy](#)^[24] and highlights the grand achievement that is transformation from a single cell into an entirely new individual. The newly born baby depends on adults for warmth and nutrition, although all other functions rest solely in her tiny hands.

Sources

1. *In the Womb*. DVD. Directed by Toby Macdonald. National Geographic Channel, 6 March 2005, USA: Time Warner Home

Video. (Accessed May 2, 2010).

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