

The Nine Month Miracle ©

Conception



Embryology Project
Advanced Biology, 2007-2008
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Nine Month Miracle Teacher's Guide
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Conception



Overview

Conception begins with fertilization and concludes with implantation of the blastocyst into the uterine wall. During fertilization the female egg cell and the male sperm cell unite, creating a single cell called a zygote. Hours after fertilization, the zygote starts dividing rapidly. Fertilization usually occurs in a fallopian tube. During the first five days after fertilization, the zygote divides into a blastocyst, a fluid-filled hollow structure of hundreds of identical cells. Approximately one week after fertilization, the blastocyst embeds in the uterine wall. After gestation (pregnancy) of nine months, develops into a human being with hereditary information from both its mother and father. This information is stored as chromosomes within the zygote and within each successive cell's nucleus. The hereditary information determines features such as eye color and hair color.



Animations

Conception

During sexual intercourse, sperm are released into the woman's vagina near the cervix, which is the entrance to the uterus. The sperm swim through the uterus and up the fallopian tubes. A sperm has three parts: a head, a middle section, and a tail. The tail propels the sperm through the uterus. The sperm's head is covered with an enzyme cap that will help it break through the egg cell's outer wall. Also, within the head are clumps of chromosomes.

After ovulation, the egg cell moves through the fallopian tube. It is moved along by the beating motion of tiny cilia that line the walls of the tube. Unless it becomes fertilized, an egg can survive for only 12 to 24 hours after ovulation. The woman's reproductive tract, with its acidic lining and host of cellular defense mechanisms, is a hostile environment to sperm. The approximately 200 sperm that succeed in reaching the fallopian tubes are the only survivors of about 300 million released into the woman's vagina during ejaculation.

Fertilization begins when one sperm cell finally succeeds in breaking through the egg cell's outer membrane. Something remarkable happens immediately: the egg cell locks out other sperm cells so they cannot enter, ensuring that only one sperm fertilizes the egg. In the final stage of fertilization the sperm cell releases its nucleus, which contains the father's chromosomes. Then after several hours inside the egg, the sperm nucleus unites with the egg nucleus, which contains the mother's chromosomes. When the two nuclei fuse, their genetic materials combine to create a zygote, or fertilized egg cell.

Chromosomes contain the father's contribution of the genetic material, or genes that transfer hereditary information to the baby. If a sperm containing a Y chromosome fertilizes the egg, the baby will be a boy. If the sperm contains an X chromosome, the baby will be a girl. Genes on the chromosomes determine thousands of other characteristics besides the sex of the baby. These include height, body shape, facial features, and eye color. Genes may even influence characteristics like talent and aptitude.

Egg Cell Production

The key female reproductive organs involved in menstruation and ovulation are the uterus, ovaries, fallopian tubes, and vagina. Inside the ovary are immature egg cells called oocytes. The oocytes are already formed in an ovary before a woman is born. About 350,000 oocytes lie within each of her ovaries in their undeveloped form when she is an eight-month-old fetus in her mother's womb.

Beginning when a girl is about twelve, she menstruates approximately every twenty-eight days. During the menstrual cycle, hormonal messages from the brain cause the ovaries to develop a single oocyte into a mature egg cell for potential fertilization. Other hormones instruct the uterine lining to thicken, so it will be ready to nourish the fertilized egg cell. Hormones are chemicals released into the blood stream by organs or glands. In general, their job is to regulate body functions by either stimulating or inhibiting other cells and organs. An ovary is one of the female reproductive organs regulated by hormones. The hormones that control the life cycle of an egg maintain a delicate balance.

The 28-day menstrual cycle starts when a follicle grows within an ovary. A follicle is composed of a developing egg cell and the support cells that surround and nourish it. On day one of the cycle, a small structure in the brain, the pituitary gland, releases two hormones, follicle-stimulating hormone (FSH) and luteinizing hormone (LH), both of which cause the follicle to begin growing. Over the next 13 days, the growing follicle releases estrogen, a hormone that prepares the lining of the uterus to receive a fertilized egg cell. Meanwhile, the estrogen in the blood stream causes the brain to release a surge of LH. In response to the LH surge, the follicle enlarges rapidly, until on day 14, the swollen follicle ruptures and spews out the egg cell. This release of the egg cell from the follicle is called ovulation.

The ruptured follicle begins secreting the hormone progesterone, which also helps to prepare the uterine lining for a fertilized egg cell. The egg cell released from the ruptured follicle must make its way into the entrance of the fallopian tube. Small, waving structures, fimbriae, at the opening of the fallopian tube sweep the egg cell into the fallopian tube and toward the uterus. Once the egg cell is within the fallopian tube, one of two things will happen to it: either a sperm cell will fertilize it, or fertilization will not take place. If the egg cell is not fertilized within 12 to 24 hours after its release from the ovary, it will stop developing and will dissolve before reaching the uterus. The absence of a fertilized egg cell gradually causes the woman's body to stop releasing the hormones that would otherwise prepare her uterus for a developing embryo. In addition, her uterus sheds its lining on days 24 through 28 during menstruation.

If the egg cell does become fertilized by a sperm, the fertilized egg is transported by tiny hairlike cells called cilia to the uterus. There it lodges in the uterine wall by a process called implantation, and it begins receiving nourishment from the uterine lining. Meanwhile, back in the ovary, the remaining cells of the ruptured follicle produce the hormone progesterone so the uterine lining will remain rich in blood vessels and the fertilized egg cell will survive.

Sperm Production

Key male reproductive organs include the testes, urethra, vas deferens, prostate gland, seminal vesicles, and penis. The testes contain coiled structures called seminiferous tubules, which are the sites of sperm production. A woman's ovaries usually produce only one egg per month, while a man's seminiferous tubules produce more than 12 billion sperm per month. On top of the seminiferous tubules is the epididymis. The immature sperm migrate there to mature, and after maturing they are stored there. The migration of the sperm from the seminiferous tubules to the epididymis usually takes about 20 days.

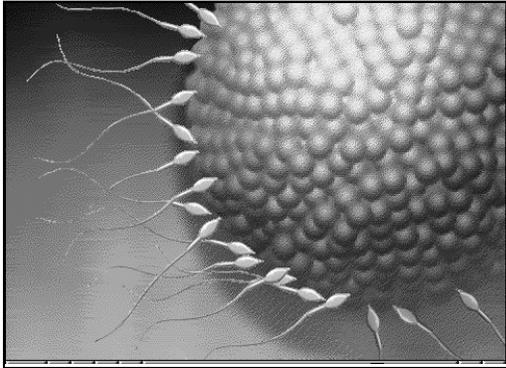
Before intercourse, the penis fills with blood and becomes erect. With sufficient stimulation, an ejaculatory process begins. Mature sperm travel from the epididymis through the vas deferens, which is a narrow, muscular tube about 18 inches long. Its smooth muscle contractions propel the sperm forward. They arrive first at the ampulla, the widest part of the vas deferens, and then they pass into the ejaculatory ducts. Next, a liquid secretion from the seminal vesicles mixes with the sperm. This secretion contains fructose (a sugar), which sperm use as fuel. It also contains alkalines, which help to counteract the naturally acidic environment of the woman's vagina and uterus. The secretions are propelled forward through the ejaculatory ducts toward the urethra, passing first through the prostate gland, where milky prostatic fluid is added, forming the substance called semen.

Finally about a teaspoon of semen is ejected, or ejaculated, through the end of the urethra at the end of the penis. From the time the sperm leave the male body, they have between 12 and 48 hours to find and fertilize an egg cell. Most of the sperm will not make it. Of approximately 300 million sperm in one ejaculation, only about 200 will survive to reach the egg cell; only one of those might succeed in fertilizing it.



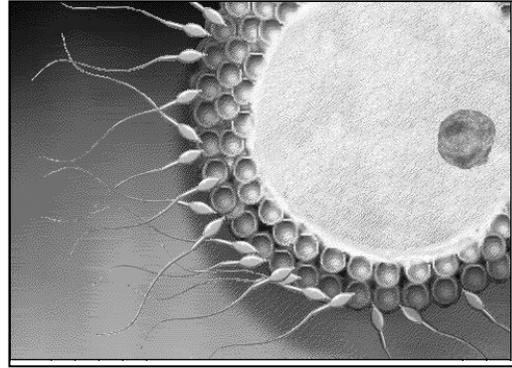
Conception

Millions of sperm swim to the egg.

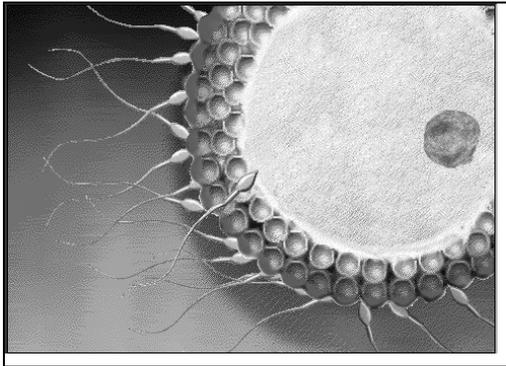


Only one sperm enters. A barrier forms, preventing more sperm from entering the egg.

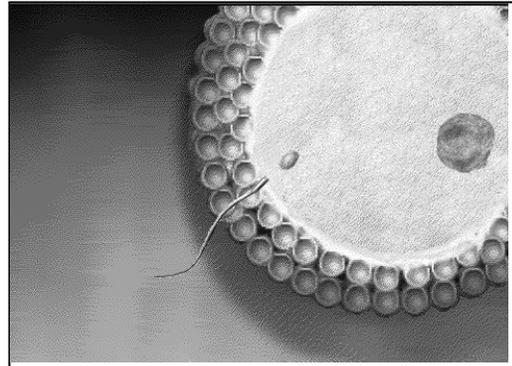
Sperm secrete an enzyme that breaks down the protective covering around the egg.



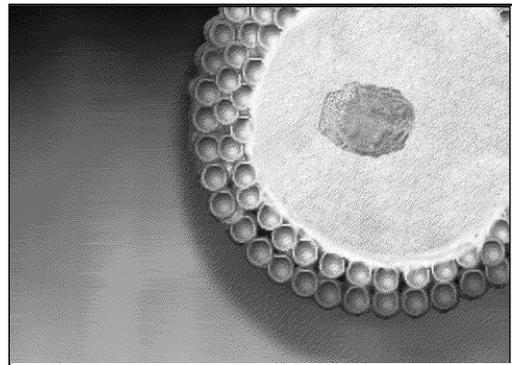
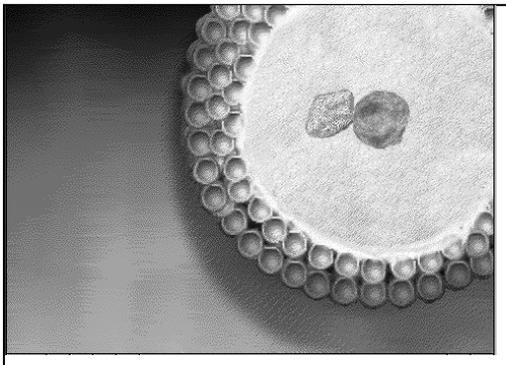
The head of the sperm that contains the nucleus breaks off.



The two nuclei unite.



Together they form a zygote.





Key Terms

cell
chromosomes
conception
egg cell
ejaculation
enzyme
estrogen
fallopian tube
fertilization
follicle
gamete
gene (adjective: genetic)
genetic material
gestation (also: pregnancy)
hormone
ovary
ovulation
progesterone
seminiferous tubule
sperm cell
testis
testosterone
zygote

Terms outside *Nine Month Miracle* Dictionary

DNA
infertility
in vitro
menstruation
nucleus (plural: nuclei)
Tay-Sachs disease
sickle cell anemia



Prefixes, Suffixes, & Roots

an-, without
cella, chamber
chrom, color
chromosomes, colored bodies
con-, with, together
DNA, deoxyribonucleic acid
fertil, fruitful
folliculus, little bag
Fallopio, Gabriel, Italian anatomist (1523-1562), first described fallopian tubes
ferous, carrying
gam-, marriage
gen, generate, generating
gest, carried
haima, blood
horman, to urge on
jaculari, to throw
mens, month
nucl-, a little nut
oestrus, frenzy
ov-, egg
pro-, for
semen-, **semin-**, seed
som, **-some**, body
sperm, seed, semen
testi, a witness (of virility)
vitro, glass
zume, leaven

Conception Worksheet

Name _____ Date _____



Nine Month Miracle References

Anatomy

Full Anatomy
Reproductive System

Animations

Conception
Egg Cell Production
Kids - Is it a Girl or Boy?
Kids - Where Babies
Come From
Sperm Production

Reference Text

Conception
Due Date
Multiple Pregnancy
Pregnancy,
Body Changes in
Pregnancy,
General Conditions of

Videos

Discovery of Pregnancy
Pregnancy Test

The most precarious time for an embryo is during its early organ formation and tissue differentiation at the initial stage of pregnancy, when the woman often is still unaware of her pregnancy.

The Long Journey

You are babysitting for a nine-year-old child whose family is expecting a baby. The child wants to know:

- How did a baby inside my mother get started?
- Will it be a girl or a boy?
- Will it look like me?
- When can a girl or a boy become a parent?



As the questions continue, your own come to mind:

- Where do eggs and sperm form?
- What challenges does a sperm have to overcome to fertilize an egg?
- At what age can a person conceive a baby?

You forgo retelling the myths about birds, bees, and storks, and decide to go clean. You will make a classic comic book that explains, frame by frame, the perilous journey that the sperm undertakes until it eventually fertilizes the egg. Your classic comic will cover:

- development of the sperm and the egg
- a description of the function and location of body structures involved
- the role that hormones and enzymes play in conception

Luckily your copy of *Nine Month Miracle* provides the information you need. Refer to the *Nine Month Miracle* References listed on this page, then turn to the next page and create your classic comic book as follows:

- 1 If a hint appears on top of each frame, read it to guide you in writing a caption below the frame.
- 2 Illustrate the captions by drawing in the blank frames.

Your classic comic should feature main characters and include terms such as gamete, menstruation, ovulation, egg cell, fallopian tubes, ovaries, follicles, hormones, sperm, ejaculation, fertilization, conception, nucleus, zygote, growth, and birth.

- 3 Give the classic comic a title.
- 4 Share your work with the class.



Classic Comic

Name _____ Date _____

Meet the characters

The egg cell matures

The egg is released

The egg cell travels to the meeting place

How the male produces sperm cells

Why only one sperm cells enter the egg cell

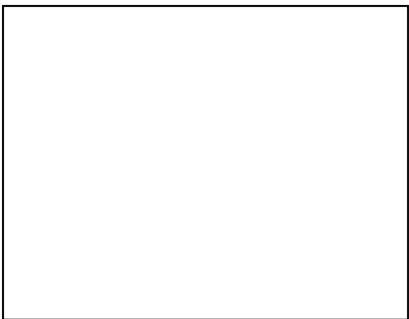
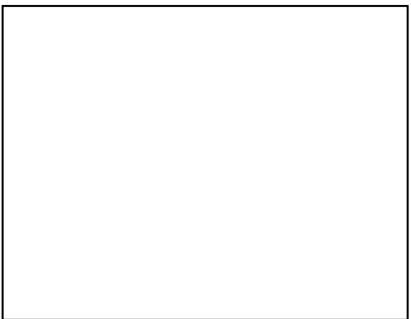
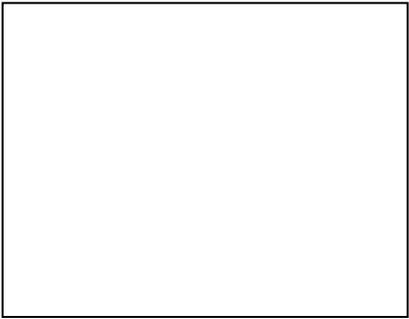
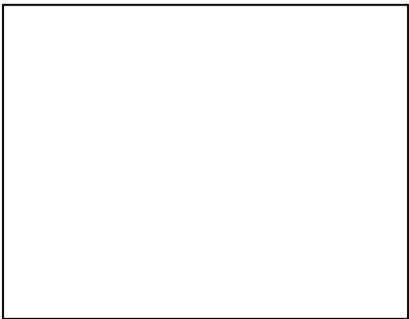
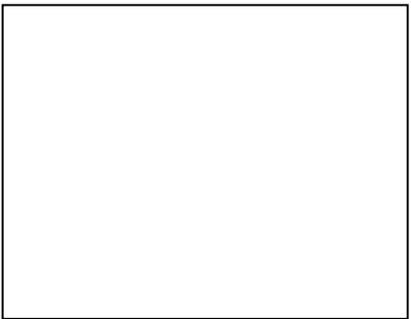
What is produced when the sperm and

What happens next inside the female's body

What's ahead

Classic Comic

Name _____ Date _____

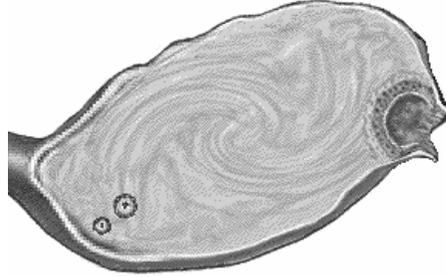


Menstruation Storyboard

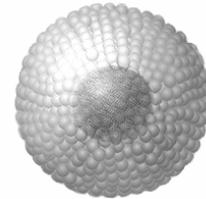
Name _____ Date _____

Write the events that happen to an unfertilized egg when it leaves the ovary. Include the terms fallopian tube, uterus, and menstruation.

1. _____



2. _____



3. _____



4. _____

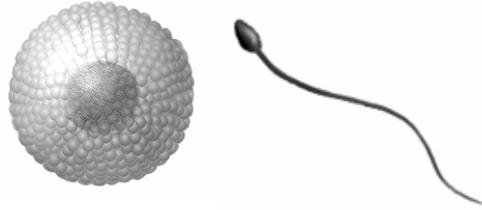


Implantation Storyboard

Name _____ Date _____

What happens to an unfertilized egg from the time it meets a sperm cell until implantation?

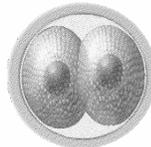
1. _____



2. _____



3. _____



4. _____



5. _____



6. _____



7. _____

