

The birth of a foal is the end of a wondrous process. It starts with the merging of two tiny cells - one from the female animal (mare), one from the male (stallion). With the joining of these cells, a new animal is conceived.

The cell from the female is called an egg, or ovum. The cell from the male is a sperm. The egg and sperm are both sex cells, the very special cells that contain the genetic material an animal inherits from its parents. Two microscopic cells will completely determine the genetic makeup of the offspring. See the discussion of genes and chromosomes in the guide sheet entitled "How Inheritance Works in Horses".

The production of sex cells is a unique and interesting process. Each of the two sexes has special organs to produce sex cells and carry out the process of reproduction. These are called the reproductive organs. Much of the reproductive process is regulated by secretions from the body's mature gland, the pituitary. A knowledge of many specialized terms are essential for you to properly understand and discuss this reproductive process.

*Study This Specialized Glossary Before Proceeding*

## SPECIALIZED GLOSSARY

**Accessory glands** (ak-ses-o-ri). These glands are located along the urethra of the male. They produce fluids that nourish and preserve sperm.

**Birth canal** The birth canal includes the cervix and the vagina of the female. They are the organs through which the unborn animal passes at birth.

**Cervix** (sur viks). This is the narrow passage or doorway between the female's vagina and uterus.

**Corpus luteum** (kor pus lu te-um). A solid mass that forms in the follicle after the egg has left. It produces a hormone which helps maintain pregnancy. It prevents other follicles from developing while the unborn animal is growing in the uterus.

**Epididymis** (ep I-did I-mis). A mass of tubes connected to the testicle. Its main function is to store sperm.

**Estrogenic Hormones** Hormones that stimulate the development and maintenance of feminine sexual characters. The principal estrogenic hormones are:

a) estradiol; b) estrone; c) estriol.

**Estrus** (es trus). The estrus period is commonly called "heat."

**Fetus** (fe tus). The unborn animal as it develops in the uterus.

**Follicle** (fol I-k 1). A bubble-like structure on the ovary which contains an egg.

**Follicle stimulating hormone (FSH)**. Comes from the pituitary and causes follicle growth.

**Hormone** (hor mon). A body-regulating chemical secreted by a gland into the blood stream.

**Infundibulum** (in fun-dib u-lum). The funnel-like membrane that surrounds the ovary. It catches the egg when it is released by the ovary.

**Luteinizing hormone (LH)**. Comes from the pituitary and regulates corpus luteum in female and testosterone secretion in male.

**Nucleus** (nu kle-us). The dense center of a cell. It contains the genetic material.

**Ovary** (o va-ri). A female organ that produces eggs. There are two ovaries.

**Oviduct** (o vi-dukt). The tube which carries the egg from the ovary to the uterus.

**Ovulation** (o vu-la shun). The time when the follicle bursts and the egg is released.

**Ovum** (o vum). Scientific name for egg.

**Placenta** (pla-sen ta). The membrane by which the fetus is attached to the uterus. Nutrients from the mother pass into the placenta and then through the navel cord to the fetus. When the animal is born, the placenta is expelled. It is commonly called the "afterbirth."

**Pituitary** This gland located at the base of the brain secretes hormones which regulate the body.

**Progesterone** A steroid hormone secreted by the hypertrophied cells of the corpus luteum. It inhibits the action of estrogens. It aids in the development of the uterus for implantation and effective nutrition of the embryo.

**Prolactin** A hormone produced in the anterior pituitary gland. It initiates lactation or in the case of nursing mothers milk secretion is stimulated.

**Sex cells** The egg and the sperm. They transmit genetic material from the parents to the offspring.

**Scrotum** (skro tum). The sac-like pouch that suspends the testicles outside the male animal.

**Sperm** Male sex cells produced in the testicles.

**Semen** (se men). Sperm mixed with fluids from the accessory glands.

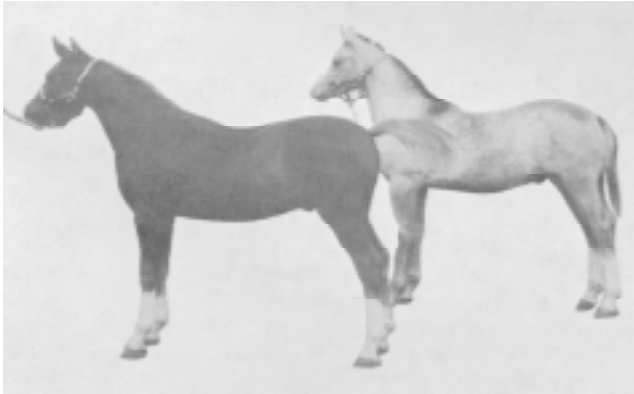
**Testicle** (tes ti-k 1). A male gland which produces sperm. There are two testicles.

**Urethra** (u-re thra). The tube through which both semen and urine pass through the penis of the male.

**Uterus** (u ter-us). The muscular, spongy organ of the female where the unborn animal develops. It is commonly called the womb.

**Vagina** (va-ji na). The canal which leads from the uterus to outside the female. Sperm is deposited there by the male, and the fetus passes through the vagina at birth.

**Vas deferens** (vas def e-renz). The tube that carries sperm from the epididymis to the urethra in the male.



### MALE REPRODUCTIVE ORGANS

The primary sex organ of the stallion is the testicle. (There are 2 testicles.) The testicles produce sperm in the mature individual and also produce a hormone called testosterone. Testosterone regulates and maintains the male reproductive tract in its functional state. Testosterone is also responsible for the masculine appearance and behavior of the stallion.

Each testicle contains a mass of minute, coiled tubules. The inner walls or surface of these produce the sperm. The numerous thousands of minute tubules merge into a series of larger ducts which pass out of the testicle to a larger, coiled

tube located adjacent to the testicle. This tube, the epididymis, is the place where sperm are stored while they mature. Sperm formation in the male is a fairly continuous process.

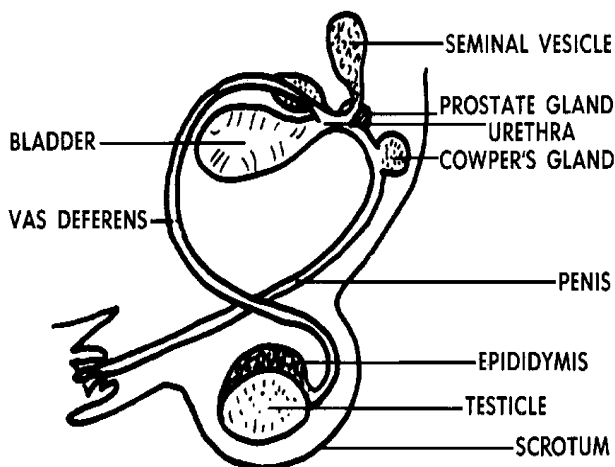
The testicles and epididymides are located in the scrotum which regulates the temperature of these structures. The scrotal temperature is several degrees cooler than that of the body cavity which is necessary for the normal development of sperm.

From the epididymis, the sperm move through a tube, the vas deferens, into the urethra. The urethra is the tube that carries urine from the bladder through the penis. The urethra also carries sperm from the junction with the vas deferens to the end of the penis.

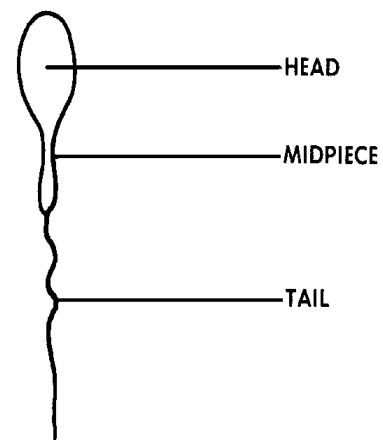
Along the urethra are the accessory glands. Their names are the prostate, the seminal vesicles and Cowper's gland. They produce fluids that nourish and preserve the sperm. During mating, the accessory glands discharge their fluids into the urethra. This washes the sperm forward through the penis. The combined fluid and sperm is called semen.

Puberty, or the capacity to produce sex cells, occurs in the stallion at the age of approximately one year. This is not a period of mature breeding capacity. Two-year-old stallions may be used for limited breeding service. Breeding use of the stallion should be deferred until after the age of two. Ask your veterinarian or an experienced horseman to explain care and management of the mature stallion to you.

### STALLION REPRODUCTIVE TRACT



### SPERM CELL



## FEMALE REPRODUCTIVE ORGANS

The mare's reproductive organs are quite different from the stallion's. The female produces the ova or eggs, receives the sperm from the male, and provides a place for the unborn animal to develop.

The primary sex organ of the mare is the ovary. Each of the two ovaries is usually 2 to 3 inches long and somewhat bean-shaped. The other portion of the female reproductive tract is known as the duct system. It consists of the oviducts, the uterus, the cervix, and the vagina. The various parts of the duct system are connected together and attached internally to the upper body wall by a series of ligaments.

The ovaries produce the eggs. Each egg is contained in a bubble on an ovary. This bubble is called a follicle. There are hundreds of follicles on each ovary. At the same time by a process not completely understood, one or more follicles begin to grow while the others remain small. The follicle grows until it is about an inch in diameter. It is filled with a fluid. The egg is suspended in the fluid. Near the time of mating, a hormone causes the follicle to burst.

The fluid gushes out of the follicle, carrying the egg with it. The egg is then trapped in a very thin membrane that surrounds the ovary. Shaped like a funnel, this membrane is called the infundibulum. The infundibulum narrows into a tube called the oviduct. The oviduct carries the egg to the uterus, or womb. The largest of the female reproductive organs, the uterus is where the unborn young (the fetus) will develop.

The uterus has a thick wall with heavy layers of muscles. At birth, these muscles will contract with great pressure to force the new animal through the cervix and vagina (birth

canal) and into the world. The lining of the uterus is soft and spongy, containing a vast network of blood vessels. This network of blood vessels provides a "bed" for the fertilized egg to settle into and develop.

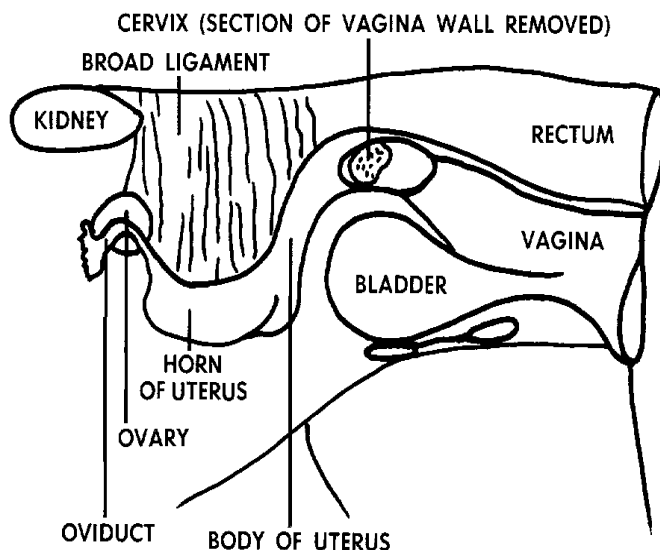
## THE ESTROUS CYCLE AND FERTILIZATION

The estrous cycle of the mare may be divided into phases, i.e., diestrus (quiet period); proestrus (preparation); estrus (heat period). The average length of the estrous cycle for mares is 22 days but may vary from 17 to 30 days. Individual mares tend to retain their individual cycle characteristics with regard to length of cycle and length of estrus.

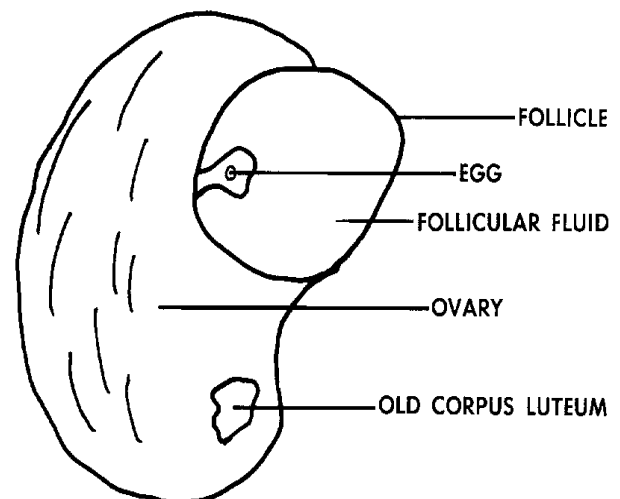
The mare is called polyestrous because she cycles continuously throughout the breeding season in the absence of conception. The mare is called seasonally polyestrous because there is seasonal fluctuation of the estrous cycle with regard to length, intensity and regularity. Most mares that exhibit no outward signs of estrus during winter months are said to be anestrus (without estrus) during that time. The estrous cycle may be irregular in the early spring.

The most easily recognized phase of the estrous cycle is estrus (heat period) or the period of male receptivity. It is caused by the relatively large amount of a hormone, estrogen secreted during this state of rapid and maximum follicle growth. The average length of estrus is 6 days but often varies from 2 to 11 days. Periods usually decrease in length as the summer progresses. Ask your veterinarian or an experienced horseman to explain the external signs of estrus and for instructions on management of your mare during the breeding season.

MARE REPRODUCTIVE TRACT



OVARY OF THE MARE



The period when a mare is out of estrus is generally called diestrus. This phase or stage usually varies from 10 to 18 days. The first part of diestrus involves corpus luteum development. In the absence of conception, the corpus luteum regresses within a few days and new follicle development once again takes place under the influence of a hormone (FSH) from the pituitary gland. The period of rapid follicle growth at the termination of diestrus is commonly referred to proestrus.

Many mares are capable of first reproduction at 4 years of age. Regular annual foaling is conducive to total life-time production. In most cases it is advisable to have mares examined for reproductive status prior to breeding. Policies regarding general sanitation, safety, and medical aspects should be observed in all equine breeding programs.

Fertilization is the process of the uniting of the sperm and the ova. The tubular or duct portion of the female reproductive tract undergoes rhythmic contractions during estrus and this activity is stimulated by mating at which time the sperm is deposited in the tract. This pulsating action plus the locomotion of the sperm in a fluid medium transport the sperm through the cervix and uterus into the oviducts. The sperm and the egg unite in the oviduct.

Only one sperm fertilizes a single egg although several million sperm may be present in the reproductive tract of the female. Only one egg is usually present per conception in horses. Sometimes a mare will produce two eggs and if both are fertilized, twin embryos will start to develop. Identical twins result from a different situation. In this case a single egg divides into two independent cells or cell masses at a very early stage of development. Twin embryos are undesirable in horses because they are generally aborted prematurely.

The egg produced by the mare is small in size although it is much larger than a sperm. The egg has a nucleus which contains the genetic material. The sperm has a much different shape than the egg which is basically round. The sperm has a head, a middle section and a tail. The physical movement of the latter structure gives the sperm cell its property of locomotion in a fluid medium. The genetic material of the sperm cell is contained in the head section.

Upon fertilization, a sperm penetrates the outside membrane of the egg and the head section is drawn into contact and union with the nucleus of the egg; thus the genetic composition of the new individual is established. Fertilization is also the stimulus for the egg to divide and grow to form the new individual.

The fertilized egg usually undergoes its initial cleavages or divisions in the oviduct. Meanwhile, it is transported to the uterus where development progresses.

## PREGNANCY AND BIRTH

Pregnancy is the time during which the fertilized egg develops in the uterus. This process is also known as gestation. For a period of about six weeks, the cell mass resulting from the fertilized egg grows as a "free floating" object in the uterus. During this time, the fetal membranes commence to form. Nourishment of the new individual during this early stage is provided for by uterine secretions. The hormone progesterone secreted by the corpus luteum assist in regulating the reproductive tract during pregnancy.

At approximately 6 weeks of pregnancy, the placenta attaches to the wall of the uterus and then provides for the nourishment of the fetus. Nutrients and oxygen are carried from the mare to the fetus and waste products from the fetus are eliminated through the placenta. The navel cord connects the fetus to the placenta.

The process of gestation in the mare requires about 340 days; however, it may vary from approximately 300 to more than 400 days following breeding. The fetus develops gradually although the most rapid period of growth takes place during the last 3 or 4 months of pregnancy.

Successful pregnancy ends in birth or parturition. At the proper time due to hormone action, the strong muscles of the uterus contract forcing the new animal through the birth canal and into the world. Until, now, the young animal received nutrients and oxygen from its mother's blood stream. But at birth the navel cord is broken. The animal must live on its own. Apparently the breaking of the navel cord stimulates the animal to breathe. This solves the problem of oxygen. As for nutrients, the mother's body has been preparing them for many weeks. The hormones produced during pregnancy have stimulated the milk glands. By the time of birth, they are ready to provide milk. Later, the mare will expel the remainder of the fluids and placenta to the completion of parturition. The entire process may require several hours.

Milk production and "letdown" is initiated by hormones secreted by the pituitary gland. The first milk or colostrum is seen just prior to or after parturition. Colostrum is very high in proteins and other nutrients which provide the foal with resistance to infections. It is very important to the new born foal that it receives the colostrum. The colostrum is exhausted and replaced gradually with normal milk by about two days after the initial nursing.

There will always be reproductive problems among horses but interferences may be minimized by good management practices. An understanding of some of the basic principles of the processes of reproduction can aid horse breeders materially in dealing with difficulties likely to be encountered.