Chapter 4

# Reproduction

Reproduction is the process by which animals produce young or offspring. Successful reproduction in goats requires proper function of the reproductive systems in both the male (buck) and female (doe). Knowledge of the organs of the reproductive systems and their functions in goats, as well as an understanding of useful reproductive management tools, helps you successfully care for your animal.

## Female Reproductive System

### Parts of the Female Reproductive System

The female reproductive system has two major roles: (1) to produce eggs (also known as gametes or ova), and (2) to provide a place for development and nourishment of kids before birth.

The major organs of the female reproductive system include the ovaries, oviducts, uterus, cervix, and vagina (see figure 4.1). Each female reproductive organ has a unique function:

| | |
|---|---|
| Ovaries | —Produce eggs in small blister-like structures called follicles<br>—Produce the hormones estrogen and progesterone |
| Oviducts | —Small tubes leading from each ovary to the uterus<br>—Site of fertilization |
| Uterus | —Site of growth and development of kids |
| Cervix | —Part of the birth canal<br>—Helps to protect the uterus |
| Vagina | —Part of the birth canal<br>—Site where sperm are deposited during natural mating |

### Hormones of the Female

Chemical compounds released into the blood by various organs control the reproductive systems of both does and bucks. These chemical compounds are called hormones. Examples of hormones important in controlling reproduction in goats are progesterone, gonadotropin releasing hormone (GnRH), and testosterone. Control of the reproductive system begins in a portion of the brain called the hypothalamus. The hypothalamus makes GnRH. The GnRH causes release of additional hormones called luteinizing hormone (LH) and follicle-stimulating hormone (FSH). The pituitary gland produces LH and FSH. These hormones are responsible for sperm and follicular development in bucks and does, respectively.

The primary hormones involved in the female reproductive system are described in table 4.1.

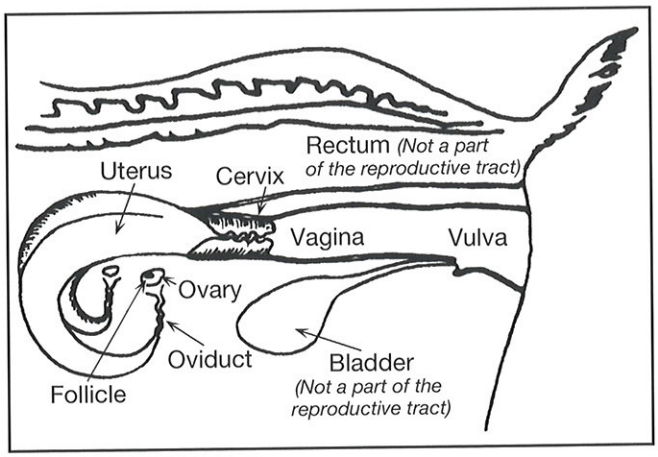


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Figure 4.1. Female reproductive system.

**Table 4.1.** Hormones of the female goat.

| Hormone | Site of Production | Hormone Function in Does |
|---|---|---|
| Estrogen | Ovarian follicles | Causes estrus (heat) |
| Progesterone | Corpus luteum (on ovary) | Quiets reproductive tract<br>Necessary for maintaining pregnancy |
| Luteinizing hormone (LH) | Pituitary gland | Causes ovulation and formation of a corpus luteum |
| Follicle stimulating hormone (FSH) | Pituitary gland | Stimulates development of ovarian follicles |
| Prostaglandin | Uterus | Restarts the estrous cycle by destroying the corpus luteum |
| Gonadotropin releasing hormone (GnRH) | Hypothalamus | Causes release of LH and FSH |
| Oxytocin | Pituitary gland | Stimulates contraction of muscles of the mammary gland and uterus, causing milk let-down and aiding in the birthing process |
| Melatonin | Pineal gland | Stimulates release of GnRH |

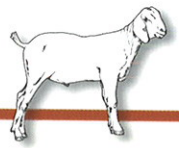
## Estrus and the Estrous Cycle

Changes in the concentration of different reproductive hormones that stimulate changes in structures on the ovaries cause a repeated pattern called an estrous cycle. The estrous cycle is usually characterized by development of follicles, the bursting of the follicles (ovulation) to release the eggs, and the formation of corpora lutea (CL) from the follicular tissue. An estrous cycle typically occurs every 21 days and begins and ends with the doe showing estrus (heat). Estrus is the period of time when the doe is receptive to mating and is in a standing heat. Does are typically in estrus for 24 to 36 hours. Approximately 18 hours after the beginning of estrus, ovulation occurs, meaning that an egg is released from the ovary and travels into the oviduct for the possibility of fertilization. If the egg is not fertilized by sperm, the doe comes into estrus 21 days later and starts the cycle over again.

## Seasonality

In general, goats are seasonal breeders, meaning that they show estrous cycles during a specific season of the year. The estrous cycles of goats are stimulated to begin when the days are becoming shorter in the late summer and fall. The typical breeding season of does occurs from late August through late winter.

Day length is perceived by the eye through the optic nerve. The optic nerve affects function of the pineal gland and its secretion of the hormone, melatonin. Melatonin is produced and released during hours of darkness and stimulates the release of GnRH from the hypothalamus. As a result, when day length is shorter during fall months, more melatonin is released. As more melatonin is released, GnRH release is also stimulated. With increasing GnRH, the estrous cycle is resumed and the doe exhibits estrus.



Goat breeds vary in their degree of seasonality. Boer and Pygmy goats, for example, exhibit extended breeding seasons as compared with Saanen or American Alpine breeds. Estrous cycles may be induced "out of season" by controlling artificial lights to simulate decreasing length of daylight.

## Conception and Birth

Fertilization is the union of an egg and a sperm. Fertilization occurs in the oviduct and results in the formation of a single-celled organism called a zygote. As pregnancy progresses, the cells continue to divide, forming an embryo, which eventually develops into the kid. The embryo travels from the oviduct into the uterus of the doe. Approximately 20 days after ovulation, the embryo attaches itself to the wall of the uterus where it grows throughout pregnancy. *Corpora lutea* that form on the ovaries produce progesterone and help maintain the doe's pregnancy. Progesterone also prevents other follicles from ovulating so that the doe cannot get pregnant while carrying the kids. Gestation (pregnancy) usually lasts between 148 and 152 days or 5 months, with slight variations across different breeds.

Kidding time is a busy and important time for you and the doe. Most importantly, be alert that kidding time is coming so that you are on hand to give the doe assistance if needed, to take care of the kid and see that it is all right, and to do whatever else you need to do at that critical time. At approximately day 150 of gestation, the kids start to send signals to the doe that initiate the birthing process. The hormones oxytocin and relaxin increase. These two hormones are responsible for helping the doe deliver the kids. Oxytocin stimulates muscular contractions of the uterus, which help push the kids out of the uterus and into the birth canal (cervix and vagina). Relaxin causes important tissues in the birth canal to relax so that the kids can be born more easily.

When the doe is about to kid, she should be watched carefully for any signs of trouble or distress. Some signs that a doe is ready to give birth are shown in figure 4.2.

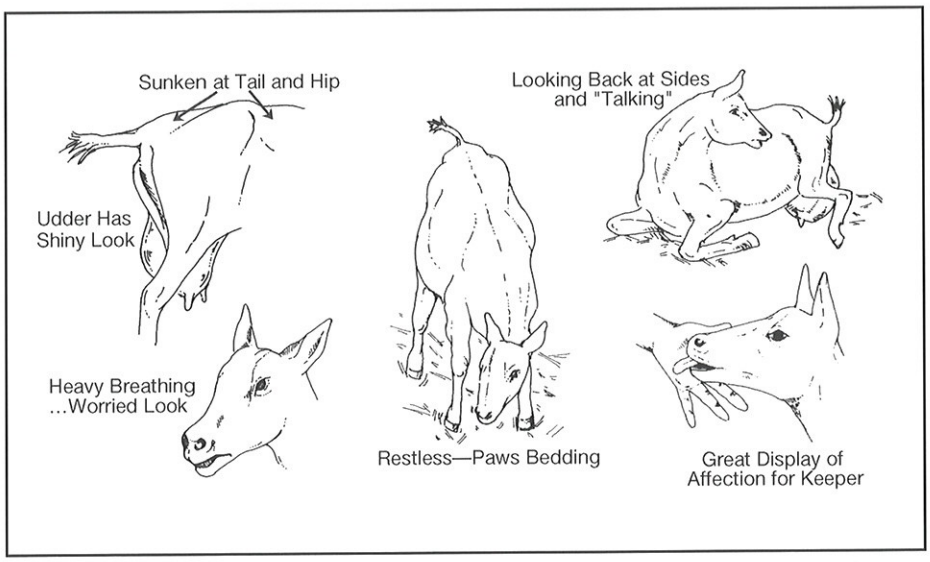



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Figure 4.2. Signs that a doe will soon give birth.

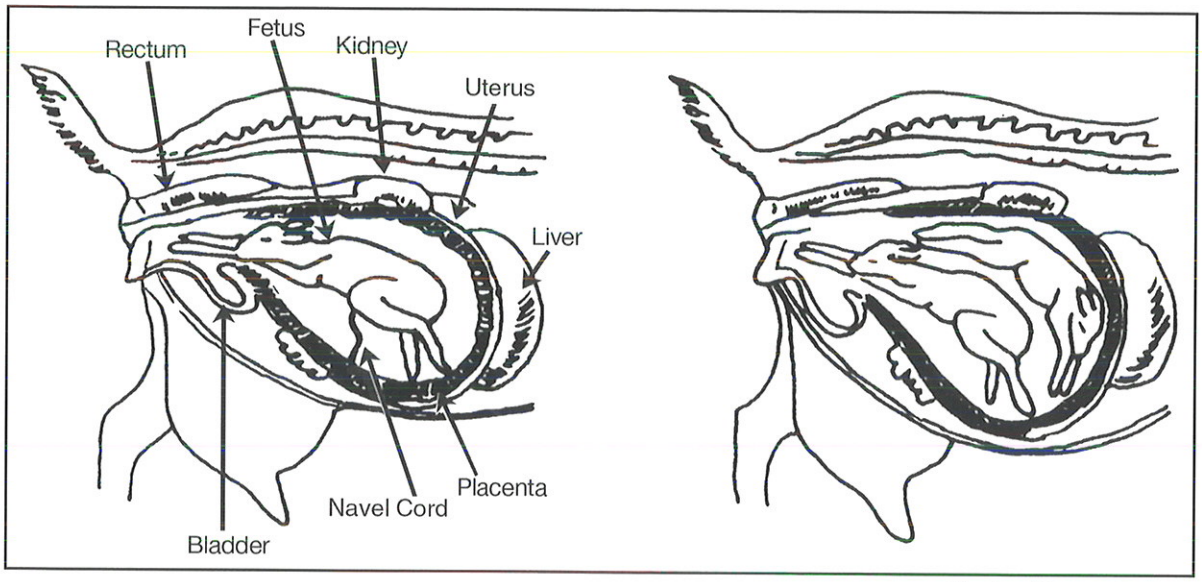


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Figure 4.3. Anatomy of a pregnant doe.

Multiple births are very common in goats. This means that a doe often has more than one kid at a time. Normally, a kid is born with the front feet on each side of the head or with both back feet coming out first. If only the kid's head can be seen or if only the head and one leg are visible, the doe should be examined immediately, as she may need help. Possible birthing positions are shown in figure 4.3.

Once the kid is born, several things must be done to get the kid off to a healthy start. First, clear the nostrils and mouth of mucous to make sure normal breathing can take place. Also, disinfect the kid's navel with an iodine solution.

The first milk produced by the doe after kidding is called colostrum. It is important that kids receive colostrum within the first few hours of life because it contains antibodies important for disease protection. Colostrum is also rich in fat, protein, and vitamins that are important for a strong, healthy start in life.

## Male Reproductive System

### Parts of the Male Reproductive System

The primary function of the male reproductive system is to produce sperm (also known as gametes).

The major organs of the male reproductive system include the testicles, epididymis, vas deferens, the urethra, the accessory glands, and the penis. Each male reproductive organ has a unique function:

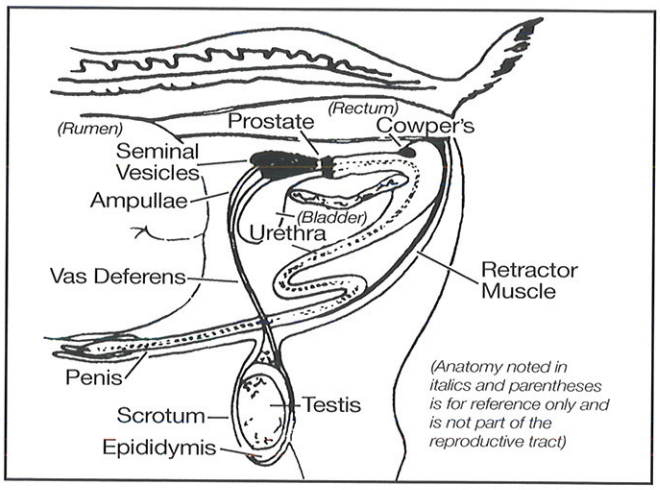


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Figure 4.4. Male reproductive system.

Testicles
- Also referred to as the testes (singular = testis)
- Paired organs that produce sperm and secrete the hormone testosterone

Epididymes
- Lie next to the testes
- Site of temporary storage and maturation of sperm (singular = epididymis)

Vas deferens
- Small tubes leading from each epididymis to the urethra
- Transport sperm when mating occurs

Urethra
- Tube inside the penis that transports both sperm and urine
- Receives sperm from the vas deferens and urine from the bladder

Accessory glands
- The prostate gland, the two seminal vesicles, and the bulbourethral (Cowper's) gland
- Add fluid, nutrients, and buffers to the sperm to help transport them into the female and to help the sperm survive

Penis
- Delivers the sperm into the female during mating

## Hormones of the Male

The primary hormones involved in the male's reproductive system are described in table 4.2.

During mating, the retractor muscle in the male relaxes and allows the penis to be extended to deposit semen in the vagina of the female reproductive tract. Approximately 2 to 5 billion sperm are deposited, although only one is needed for fertilization of each egg.

# Reproductive Management

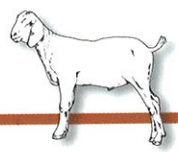
## When to Breed

Doelings that are healthy and well managed nutritionally can be bred when they are 7 to 10 months of age. Regardless of age, a doeling should weigh 60 percent of her expected adult weight when first bred. A doeling that is small or thin at breeding time may not show estrus or conceive, whereas a doeling that is too fat may have difficulty kidding and/or have lower milk production due to excess fat deposits in the udder.

Depending on the individual owner's needs or interests, doelings may also be bred at an older age the following fall to kid at approximately two years of age.

**Table 4.2.** Hormones of the male goat.

| Hormone | Site of Production | Hormone Function in Bucks |
|---|---|---|
| Testosterone | Testicles | Necessary for sperm production |
| Luteinizing hormone (LH) | Pituitary gland | Stimulates testosterone production |
| Follicle stimulating hormone (FSH) | Pituitary gland | Stimulates cells of the testicles that support sperm production |
| Gonadotropin releasing hormone (GnRH) | Hypothalamus | Causes release of LH and FSH |



## Artificial Insemination

Artificial insemination (AI) is the practice of the introduction of sperm into the reproductive tract of the female other than by natural mating. This management practice is not as common in goats as compared with other livestock, but its use is certainly increasing. Females can be inseminated with either fresh or frozen semen. AI is used by some goat producers, primarily because it enables more extensive use of genetically superior bucks. With AI, semen from the best bucks can be used by more than a few producers. Secondary benefits of the use of AI include limiting spread of reproductive diseases because bucks are not in physical contact with females, and the ability to use dead or injured sires because semen can be frozen and stored indefinitely.

Semen collected from a goat can be processed (extended) and used within 48 hours or frozen in plastic straws for later use. Semen extension includes dilution of sperm so that one ejaculate can be used to inseminate many females. Does can be artificially inseminated using one of two methods: (1) intra-uterine insemination: in this case, a small incision is made in the abdominal cavity and uterus so that the semen can be deposited directly into the uterus, or (2) trans-cervical insemination: an insemination pipette is inserted through the vagina and cervix, and semen is placed at the junction of the cervix and uterus. Goats should be inseminated 12 to 18 hours after the onset of heat.

## Detection of Estrus (Heat)

A successful reproductive program in a goat herd requires managers to properly detect estrus and understand the appropriate time to inseminate or breed animals. The most obvious signs of estrus include the following:

1. Standing to be mounted by herd mates
2. Flagging (rapid tail wagging)
3. Attempting to mount other goats
4. Excited behavior, such as walking fences, bleating, and frequent urination
5. Clear mucous discharge from the vulva
6. A swollen, red, or wet vulva

### Important considerations for maximizing efficiency of estrus detection:

- Watch! Watch! Watch! Frequency of observation of does is important. Watch does for at least ½ hour in the morning, afternoon, and at night when they are not eating or waiting to be milked (in the case of dairy goats).
- Use heat detection aids, such as a teaser wether or vasectomized buck. A vasectomized buck is sterile because the ability of sperm to be ejaculated is hindered. The buck or teaser wether can be outfitted with a marking harness so the doe's back is marked with crayon when she is mounted.

## Estrous Synchronization

Estrous synchronization is the manipulation of estrous cycles so that many does exhibit estrus or "heat" within a few days. Synchronization of estrous cycles can shorten breeding and kidding seasons and the time and labor associated with them. It also makes the use of artificial insemination easier because females are in estrus at a specific time.

Unfortunately, products effective in synchronizing estrus in goats are not approved for use in the United States. Advances continue to be made in developing

**Table 4.3.** Estrous synchronization products approved for goats other than in the United States.

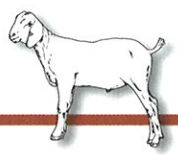
| Estrous Synchronization Products | Trade Names of Products | Function |
|---|---|---|
| Prostaglandin—PGF2α | Lutalyse®, Estrumate® | Destroys the corpus luteum; estrus will occur in 2 to 3 days |
| Intravaginal progestogen inserts | CIDR-G (controlled internal drug-release) | Progestogen acts like progesterone and thus prevents ovulation until removal |
| Pregnant mare serum gonadotropin (PMSG) | None | Stimulates ovulation |
| Intravaginal progestogen sponges | Cronogest 45, Repromap, and Veramix are the progestogen compounds contained in the sponges | Progestogen acts like progesterone and thus prevents ovulation until removal |
| Norgestomet | SynchroMate-B | Acts like progesterone and thus prevents ovulation until removal |

estrous synchronization programs and are likely to become available for widespread use in the future. Estrous synchronization programs used in other countries typically rely on a variety of compounds in combination that affect the estrous cycle of the goat in different ways. Examples of estrous synchronization products manufactured for use in goats in other countries are described in table 4.3.

## Embryo Transfer

Embryo transfer is the practice of removing (flushing) embryos from one female (donor) and placing those embryos into another female (recipient) for the remainder of development. Embryo transfer is performed in conjunction with superovulation and artificial insemination of the donor females so that several eggs are ovulated and fertilized at one time, thus resulting in the production of several embryos. Follicle stimulating hormone (FSH) is the key reproductive hormone used to stimulate the growth of multiple follicles (containing eggs) on the ovaries. After ovulation and insemination, embryos are flushed from a donor female at about seven days of age. Each embryo can either be transferred directly into a recipient female or may be frozen and then transferred later.

While use of embryo transfer is increasing as techniques become more refined in goats, it is currently used on a very limited basis. Use of embryo transfer is beneficial because it enables production of many kids in a short period of time from genetically superior females. The valuable genetics of a donor doe can be more readily realized in the industry with the production of more than two or three kids per year.

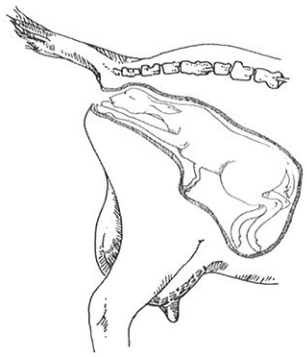


## Reproductive Problems

Maximizing fertility in a goat herd can be a challenging goal but certainly is achievable in a herd that has proper health, nutrition, and breeding management. Poor fertility or failure of a female to become pregnant within a reasonable time after puberty or kidding can be caused by a variety of factors. Inability to properly detect heat and/or inseminate at the proper time in the case of using AI are common causes of reproductive failure. Dystocia (difficulty giving birth) may also be an underlying cause of other reproductive problems related to the inability of the reproductive tract to repair itself in a timely manner for rebreeding. Dystocia is more prevalent in yearlings. Infectious and noninfectious causes of reproductive problems are shown in table 4.4. Figure 4.5 shows various birthing positions that can cause dystocia and what to do when they occur. If you need an obstetrical chain, purchase one from an obstetrical supply company. Other chain you may have is not appropriate.

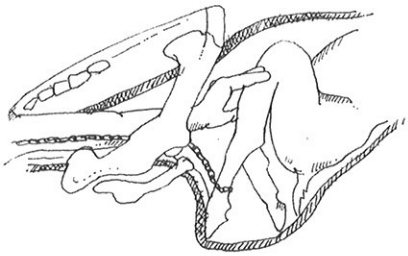
**Table 4.4.** Reproductive disorders of goats.

| Reproductive Disorder | Causes | Symptoms | Prevention/ Treatment |
|---|---|---|---|
| Cystic ovarian disease | Unknown | Infertility; lack of estrus | Not cured but may be overcome by estrous synchronization treatments using GnRH |
| Uterine infections (endometritis or metritis) | Bacterial infections | Abnormal vaginal discharge; unable to detect estrus | Minimize dystocia; cleanliness of kidding pens and equipment |
| Leptospirosis | Bacterial infection | Abortion | Vaccination |
| Vibriosis | Bacterial infection | Abortion | Vaccination |

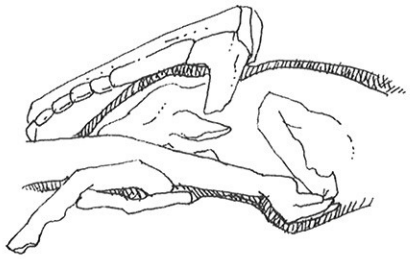


Normal anterior presentation, position and posture.

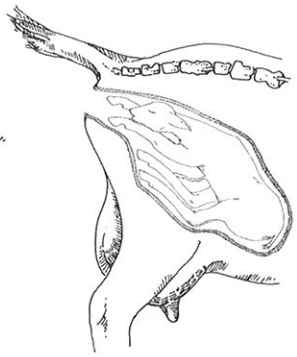
Posterior (breech) presentation of the kid. Assistance necessary if prolonged labor.



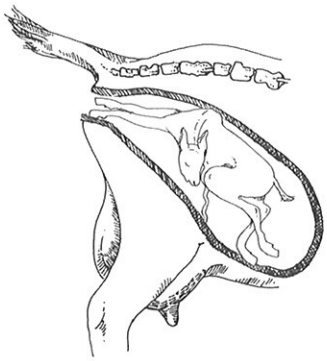
Correction of hind legs in breech presentation. Push kid forward, guide foot over pelvic rim as an assistant pulls obstetrical chain.



Correction of retained foreleg. Cup hoof with palm of hand to prevent tearing of uterus or vagina.

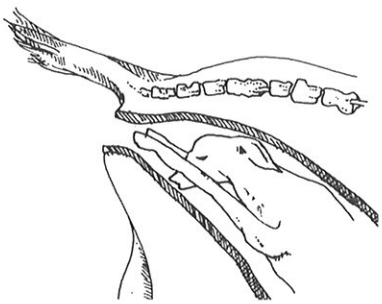


Anterior presentation with rear legs extended. Serious malpresentation. Death of kid results unless early assistance given.

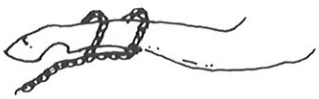


Head and neck turned back over body. Secure legs and push body forward.

Posterior presentation with fetus upside down. Never attempt delivery in this position.



Anterior presentation with vertex posture of the kid. Kids are often dead when in this position.



Correct application of obstetrical chain.

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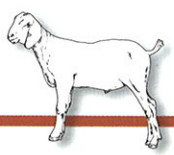
Figure 4.5. Various birthing positions.



## Genetics

**Genetics** is a branch of biology that deals with inherited characteristics and how they vary.

Each goat is made up of many, many cells. Each cell contains 60 chromosomes or 30 pairs of chromosomes, with half of each chromosome coming from each parent. Chromosomes are then made up of many different genes. These genes are responsible for each animal's physical appearance, performance (growth and/or milk production), and behavior.

The ovaries of the female and testes of the male contain eggs and sperm, respectively. Each egg and sperm contains one-half of the parent's complete genetic material. At fertilization, when the egg and the sperm join, the embryo that is formed contains the complete genetic material for a new animal, with half coming from the mother and half coming from the father. The single-celled embryo then divides into two identical cells, then into four, then 8, 16, 32, and so on until thousands of cells are made. As the embryo develops, cells start to differentiate, with some forming the heart, some the brain, some the skin, and so on. The genes in each cell control this whole development process.

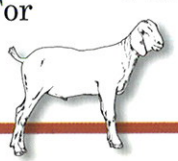
So what is a gene? A **gene** consists of a specific sequence of deoxyribonucleic acid (DNA), the genetic material that controls a trait. Some traits are controlled by more than one gene. An example of an inherited trait in goats that is controlled by one gene is polled (without horns) versus horned. Most goats are born with horns and are dehorned at an early age, but some are born polled.

Genes that control some physical traits are either dominant or recessive, depending on how they are expressed in that species. For example, being polled in goats is a dominant trait. Genes occur in pairs, with one-half of each pair coming from each parent. Dominant genes are denoted with a capital letter and recessive genes are denoted with a lowercase letter. For example, the dominant polled gene is denoted as a "P" and the recessive horned gene is denoted as a "p". To be expressed, a recessive condition, such as being horned, requires two recessive genes (pp), one from each parent. A dominant trait requires only one gene for that condition to be expressed. That is why it is called a dominant trait. An animal that has a phenotype of polled has a genotype of either "PP" or "Pp", while the horned phenotype has a genotype of "pp". **Genotype** describes the gene pair.

**Dominant versus frequent.** Even though being polled (without horns) is the dominant trait in goats, more goats are born with horns. This is because so few goats actually carry the dominant gene. In this way, a recessive gene, such as horned, can appear more frequently among a population.

Genotypes can either be **homozygous**, meaning the two genes are the same (pp or PP) or **heterozygous**, meaning the genes are different (Pp). Phenotype describes the result or expression of the gene pair. If you know the parents' genotypes, you can predict the phenotype of the offspring.

Some traits are more complex than horns. Some traits, such as milk production, are controlled by more than one gene pair and are influenced by many different factors besides genetics. Milk production is affected by genetics and by conditions such as environment, management, and nutrition. That is why we look at genetics and pedigrees of animals to try to help breed a more productive animal.



### Polled or Horned?

The buck has horns and has a homozygous genotype "pp" and the doe is polled and has a heterozygous genotype "Pp". What percentage of their offspring are likely to be horned and what percentage are likely to be polled?

An easy way to determine this is by doing a *Punnett Square*:

| Mother \ Father | p | p |
|---|---|---|
| P | Pp | Pp |
| p | pp | pp |

50% of the offspring are likely to be horned (pp) and 50% of the offspring are likely to be polled (Pp).

If both parents are heterozygous polled (Pp), the results would look like this:

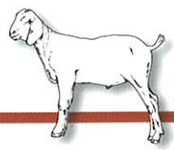
| Mother \ Father | P | p |
|---|---|---|
| P | Pp | Pp |
| p | Pp | pp |

In this example, 75% of the offspring are likely to be polled and 25% of the offspring are likely to be horned.

You can examine your animal's parents and grandparents by writing out a family tree.

As you can see in figure 4.6, an animal gets one-half of its genes from its parents, one-quarter from each grandparent, and only one-eighth from each great grandparent. Many goat breeders study pedigrees to see if they can predict the offspring's potential. Today, that effort is enhanced by the use of computers and statistical programs that determine an animal's predicted transmitting ability (PTA) and estimated transmitting ability (ETA). PTA is a measure of either yield or type evaluations for selecting the best animals for breeding programs. The higher the number, the more likely improvements will take place by using those genetics. Yield and type also can be combined into a single production/type index (PTI). ETA is an index that predicts the genetic potential of an offspring; the higher the index, the higher the genetic potential.

The United States Department of Agriculture (USDA) compiles this information for dairy goats by using DHIA records from the animal and its relatives. The reliability of the PTA is also calculated and, of course, the higher the reliability the better. The reliability of the PTA will depend on how much information is available on that animal. The PTA is usually a better gauge of an animal's genetic capability than the animal's actual performance. This is because so many environmental factors can affect production. An excellent genetic goat managed poorly is likely to produce poorly.



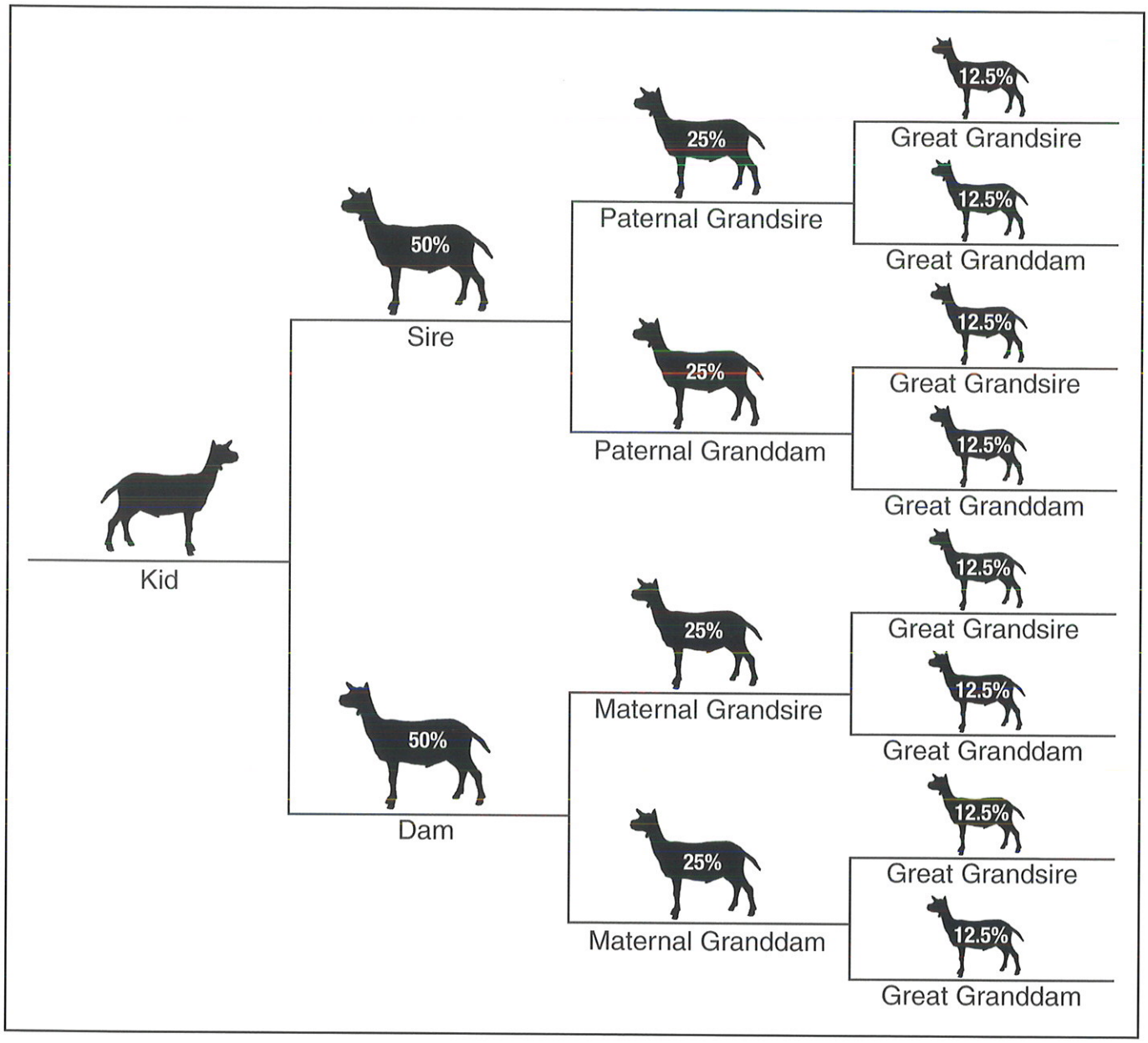



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Figure 4.6. Simplified pedigree for a dairy goat.

Some basic information on how to read the official pedigree shown in figure 4.7 is given:

## Pedigreed Goat

Name of the goat = Kastdemur's Slice of Life

*B = breed leader record

Registration number = L1373224, thus "L" indicates that breed is LaMancha

Date of birth = April 22, 2006

Sex = Buck, disbudded

Tattoo = right tail "KJD", breeder/member identification assigned by ADGA; left tail "W63", 63rd kid born in the herd during 2006 (W = 2006)

## Sire of the Goat

Name = Elm*Glen Brazil

Registration number = AL1336307, thus "AL" indicates breed is Alpine and LaMancha; breed leader record

Estimated Transmitting Ability (ETA) = 25 or 27 (two alternative methods for calculation; the higher the number the better)

## Dam of the Goat

Name = Kastdemur's Slice

Registration number = L1167141, thus breed is LaMancha

3*M = the dam has received awards 3 times for milk production

SGCH = ?

Production/type index (PTI) = 134 for production weighted over type and 102 for type weighed over production

Date of birth = 05/05/93

EEEE = dam was classified at "Excellent" for General Appearance, Dairy Character, Body Capacity, and Mammary System

PTA for milk = 201 lb

PTA for fat = 5 lb

PTA for protein = 4 lb

PTA for type = 0.30

Deviations for milk, fat and protein are 621, 16, and 14 lb, respectively

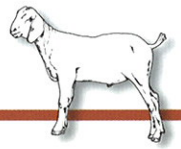
PTA$ for fat and protein are 23 and 19, respectively, with 56% reliability (R)

PTA% with 58% R calculated on July 2006 were -0.17 and -0.09 for fat and protein, respectively, as compared to calculations in November 2005

Dairy Herd Improvement Registry (DHIR) production information at 4 years of age (4-00) included 251 days in milk (DIM), 2270 lb milk, 3.6% fat, 82 lb fat, 3.0% protein, 67 lb protein, and (DCR) = 93

Lifetime production to date from 555 DIM is 5350 lb milk, 187 lb fat (3.6% fat), and 150 lb protein (3.0% protein)

The animal placed Grand Champion in 2005 at the National Show.



KASTDEMUR'S SLICE OF LIFE
L1373224 *B

04/22/2006
BUCK
DISBUDDED
RT: KJD LT: W63

KASTDEMUR'S DAIRY GOATS
11075 OLD OREGON TRAIL
REDDING, CA 96003

ELM*GLEN BRAZIL
AL1336307 *B ETA 25 27

KASTDEMUR'S SLICE
L1167141 3*M SGCH PTI 134 102
05-05 93 EEEE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PTA | 201M | 5F | 4P | .30T | | | |
| DEV | 621 | 16 | 14 | | | | |
| PTA$ | | 23 | 19 | 56R | | | |
| PTA% 58R 07/06 | -.17 | -.09 | 11/05 | | | | |
| DHIR AGE | DIM | MILK | % | FAT | % | PRT | DCR |
| 4-00 | 251 | 2270 | 3.6 | 82 | 3.0 | 67 | 93 |
| 4-11 | 304 | 3080 | 3.4 | 105 | 3.0 | 92 | 97 |
| LIFE | 555 | 5350 | 3.5 | 187 | 3.0 | 159 | |

NATL SHOW: GCH2005

ELM*GLEN WAR EMBLEM
AL1270868 *B SG PTI 96 129
02-03 89 VEE

| | | | | |
|---|---|---|---|---|
| PTA | 86M | 1F | 3P | .70T |
| PTA$ | | 9 | 11 | 33R |
| PTA% 48R 07/06 | -.10 | .04 | 11/05 | |
| D/AV | 1751 | 75 | 57 | 87 |

ELM*GLEN BRUNO BETTY
L1234634 1*M SGCH PTI 95 105
02-04 89 VEEE

| | | | | |
|---|---|---|---|---|
| PTA | 120M | 2F | 2P | .50T |
| DEV | 401 | 6 | 9 | |
| PTA$ | | 12 | 9 | 35R |
| PTA% 45R 07/06 | -.15 | -.07 | 11/05 | |

| DHIR AGE | DIM | MILK | % | FAT | % | PRT | DCR |
|---|---|---|---|---|---|---|---|
| 2-01 | 305 | 1740 | 4.1 | 72 | 3.2 | 56 | 96 |
| | 329 | 1860 | 4.2 | 79 | 3.2 | 60 | 96 |
| 3-01 | 301 | 2440 | 4.0 | 98 | 3.0 | 73 | 96 |
| LIFE | 630 | 4300 | 4.1 | 177 | 3.1 | 133 | |

BECCA'S HEMINGWAY
L1118678 +*B GCH PTI 19 21
04-01 90 EEE

| | | | | |
|---|---|---|---|---|
| PTA | 72M | -1F | 2P | .10T |
| PTA$ | | 5 | 4 | 63R |
| PTA% 56R 07/06 | -.19 | -.04 | 11/05 | |
| D/AV | 2897 | 101 | 92 | 85 |

KASTDEMUR'S SEVEN-UP
L1078808 2*M SGCH PTI 157 113
05-02 91 EEEE

| | | | | |
|---|---|---|---|---|
| PTA | 209M | 6F | 5P | .30T |
| DEV | 1042 | 37 | 29 | |
| PTA$ | | 25 | 23 | 59R |
| PTA% 63R 07/06 | -.10 | -.07 | 11/05 | |

| DHIR AGE | DIM | MILK | % | FAT | % | PRT | DCR |
|---|---|---|---|---|---|---|---|
| 0-11 | 283 | 2770 | 3.6 | 99 | 3.2 | 88 | - |
| 5-11 | 73 | 250 | 5.6 | 14 | 2.8 | 7 | - |
| LIFE | 356 | 3020 | 3.7 | 113 | 3.1 | 95 | |

NATL SHOW: RCH2001

WINTERWOOD'S MUSICIAN
L1089165 +*B PTI 79 74
03-03 90 VEE

| | | | | |
|---|---|---|---|---|
| PTA | 133M | 1F | 3P | .30T |
| PTA$ | | 13 | 12 | 54R |
| PTA% 55R 07/06 | -.19 | -.03 | 11/05 | |
| D/AV | 2011 | 79 | 62 | 85 |

ELM*GLEN EXIE
AL1157981 1*M SGCE PTI 141 175
04-03 91 VEEE

| | | | | |
|---|---|---|---|---|
| PTA | 82M | 4F | 3P | .90T |
| DEV | 514 | 21 | 15 | |
| PTA$ | | 12 | 14 | 55R |
| PTA% 57R 07/06 | .04 | .03 | 11/05 | |
| LIFE | 511 | 4100 | 4.1 | 170 3.0 124 |

HILLSIDE-HOBBY DIAMOND'S BRUNO
AL1162094 +B PTI -37 -30
03-06 90 VEE

| | | | | |
|---|---|---|---|---|
| PTA | 0M | -3F | -2P | -.10T |
| PTA$ | | -3 | -9 | 38R |
| PTA% 44R 07/06 | -.13 | -.11 | 11/05 | |
| D/AV | 1574 | 63 | 48 | 86 |

ELM*GLEN BEAUTY
L1202674 ETA 47 38

| | | | |
|---|---|---|---|
| PTA | 120M | 4F | 4P |
| DEV | 0 | 0 | 0 |
| PTA$ | | 15 | 15 |
| PTA% 36R 07/06 | -.03 | -.01 | |

ONE*OAK*HILL MEDICINE TUMULT
**DNA**
L1037227 ++*B GCH PTI 10 17
03-04 92 EEE

| | | | | |
|---|---|---|---|---|
| PTA | 24M | 0F | 0P | .10T |
| PTA$ | | 2 | 0 | 84R |
| PTA% 84R 07/06 | -.07 | -.03 | 11/05 | |
| D/AV | 2461 | 94 | 77 | 87 |

ME'S-RANCE DUTCH HESBA
L0903438 3*M GCH PTI -40 15
05-02 91 EEEE

| | | | | |
|---|---|---|---|---|
| PTA | -75M | -4F | -3P | .30T |
| DEV | 0 | 0 | 0 | |
| PTA$ | | -11 | -11 | 58R |
| PTA% 55R 07/06 | -.03 | .00 | 11/05 | |

ONE*OAK*HILL MEDICINE TUMULT
**DNA**
L1037227 ++*B GCH PTI 10 17
03-04 92 EEE

| | | | | |
|---|---|---|---|---|
| PTA | 24M | 0F | 0P | .10T |
| PTA$ | | 2 | 0 | 84R |
| PTA% 84R 07/06 | -.07 | -.03 | 11/05 | |
| D/AV | 2461 | 94 | 77 | 87 |

KASTDEMUR'S SPRITE
L1032466 1*M SGCH PTI 144 107
07-00 92 EEEE

| | | | | |
|---|---|---|---|---|
| PTA | 182M | 6F | 5P | .30T |
| DEV | -154 | -5 | -7 | |
| PTA$ | | 23 | 22 | 64R |
| PTA% 78R 07/06 | -.07 | -.03 | 11/05 | |
| LIFE | 222 | 1650 | 3.2 | 53 3.1 51 |

ADGA since 1904
American Dairy Goat Association
P.O. Box 865 Spindale NC 28160
(828) 286-3801 Fax (828) 287-0476
adga@adga.org www.ADGA.org

A * in a doe's DHIR section signifies a breed leader record.

OFFICIAL PEDIGREE AS SHOWN ON THE RECORDS OF THE AMERICAN DAIRY GOAT ASSOCIATION. 8/4/2006

Figure 4.7. Actual pedigree.