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by Thomas R. Thedford

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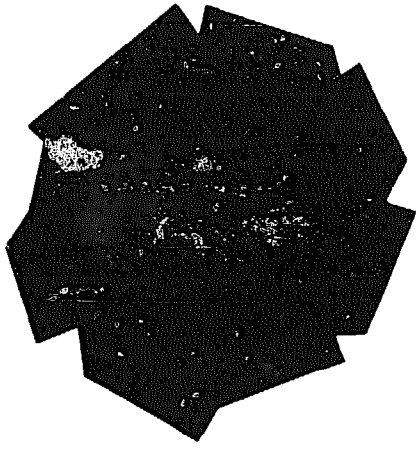
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**WINROCK  
INTERNATIONAL**

**GOAT  
HEALTH  
HANDBOOK**

**GOAT HEALTH HANDBOOK**

**A Field Guide for Producers with  
Limited Veterinary Services**

by

Thomas R. Thedford, DVM

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### Manuals

*Sheep Health Handbook: A Field Guide for Producers with Limited Veterinary Services*

### Slide Presentations

*Parasites of Small Ruminants*  
*Bluetongue in Sheep*  
*Epididymitis in Rams*  
*Sore Mouth in Goats and Sheep*  
*Abscesses in Goats and Sheep*

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## Preface

The world's goat population is approximately 470 million head. A large majority of these goats (about 443 million) are found in developing countries in the hands of small family farmers or landless people. Often, the goat is the only source of high-quality protein food (milk and meat) and cash income of large segments of the populations of many developing countries.

The importance of the goat in agricultural development has been overlooked in the past by international donor agencies and by planners and policy makers at the local and regional levels. Resource allocation and funding for research, development, and training in goat production has been minimal when compared to other species of domestic animals. Although some progress has been made in recent years in understanding the role of the goat in developing agriculture, much needs to be learned in the areas of production, management, nutrition, and disease control.

Winrock International, in its efforts to improve goat production/productivity in developing countries, has committed substantial institutional resources to the dissemination of information and the provision of technical and training services in goat production. This manual is one of a series of informational and training materials prepared in the area of goat diseases and health. The manual is intended for use in countries or localities where there is limited or no access to veterinarians. It is specifically designed to assist agricultural development workers and extension personnel in the execution of their goat production improvement programs and producer training activities.

Andres Martinez, Ph.D.  
Winrock International

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Lastly, none of this could have been possible without the assistance, understanding, patience, and love of my family. My greatest thanks and love go to my wife, Nancy, and my daughters, Becky and Miriam.

My final comment goes to you, the reader and user. I hope this handbook will assist you in developing a more productive world animal agriculture with healthier animals. This is my goal.

Thomas R. Thedford, D.V.M.

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## USING THIS HANDBOOK

You are urged to seek the assistance of a veterinarian and the use of a diagnostic laboratory whenever possible. This guide has been designed to assist with goat health care problems in areas that have limited veterinary services. The basic aim is simple: you should be able to recognize a sick goat in the early stages of the disease process. If a sick goat does not die within the first 3 to 5 days, it will usually recover without treatment. While it is sick, however, it does not gain weight or produce milk, and the disease can spread to many other animals. Thus, even if death losses are low, the producer's economic losses may be high. These losses can be decreased considerably through early diagnosis and treatment. A rapid recovery reduces the chance of the disease spreading to other animals, as does isolation, vaccination, and other preventive measures. It is hoped that you will use this guide as part of a systematic diagnosis and health care process, rather than for reference only.

Remember that diagnosis and treatment are extremely complex tasks. Diseases vary greatly in severity, both from disease to disease and within various forms of the same disease. An observed condition may have more than one cause. This makes it difficult to determine a diagnosis solely from the symptoms. The information in this guide will not allow you to make a specific diagnosis in most cases. However, it can help you to identify symptoms and narrow the range of diseases for treatment.

The handbook is divided into five major sections:

1. The **Diagnostic Guides** will help you to easily identify a small number of diseases that are the most probable causes of the symptoms that you have observed.
2. The detailed **Disease Descriptions** will allow you to reduce the number of potential diseases even further, provide appropriate treatment, and take preventive measures to avoid further spread of the disease.

3. The section on **Therapy** describes many of the antibiotics and other drugs that are used in the treatment of goat diseases. It provides information on dosage and administration. In addition, this section includes some formulas that are useful in treating sick goats.
4. **Techniques** of treatment are described and illustrated. This section covers techniques of treatment such as the sterilization of instruments and oral administration of medicine, and techniques of normal health care such as castration and foot trimming.
5. The section on **Birth and the Newborn** describes the procedures for both normal and difficult delivery, with illustrations. It also covers pre- and post-delivery care.

In addition to the main text, the Appendices include a map showing regions of the world where no incidents of specific diseases have been reported. This will assist you in determining a reasonable diagnosis. Also, the Appendices contain a list of Other Sources of Information on Diseases in Goats, a Glossary and an Index.

### **Normal Goat Physiological Data**

Temperature: 104 ± 1F, 40C.

Heart rate: 70 to 80 per minute, faster for kids.

Respiration rate: 12 to 15 per minute, faster for kids.

Rumen movements: 1 to 1.5 per minute.

Onset of heat (estrus): 7 to 12 months, depending on nutritional regime.

Length of heat: 12 to 48 hours--average about 1 day.

Heat cycle (estrous cycle): 17 to 23 days--average 21 days.

Length of gestation: 148 to 156 days--average 150 days.

### **Temperature Conversions**

	F	C
Subnormal	100.4	38.0
	101.3	38.5
	102.2	39.0

	<u>F</u>	<u>C</u>
Normal*	103.1	39.5
	104.0	40.0
	104.9	40.5
Slight Fever	105.8	41.0
	106.7	41.5
High Fever	107.6	42.0
	Or higher	

$$F = (C \times 9/5) + 32$$

$$C = (F - 32) \times 5/9$$

\* The body temperature is related to stress, exercise, and the environmental temperature. If the goat is excited, has been severely exercised, or if it is a very hot, humid day, let the animal calm down and retake the temperature.

### **Examining the Goat for Disease Symptoms**

You should observe all animals at least daily. Look for goats that show symptoms such as lagging behind the herd, poor appetite, diarrhea, limping, breathing hard or fast, grunting, grinding of teeth, or other unusual behavior. If you spot any of these signs, you will want to make a more detailed examination.

#### **Examination Checklist. (Take written notes)**

1. Look at the undisturbed animal from a distance. Note the general condition and age of the goat. Can it stand? Does it walk normally? Can it see? Is it bumping into objects? Does it exhibit signs of pain? Is it bloated? Are there swollen areas? Count respirations per minute (one count equals a complete in-and-out movement of air).
2. Approach the goat. It should be held by an assistant by the neck and body. Do not run the goat or fight it as this will cause a false temperature, pulse and respiration read-

ing. If it is easier on the assistant and if the goat struggles less, it may be laid on its side on the ground. Goats are, however, usually much happier with all four feet on the ground.

3. To take the goat's temperature, shake the thermometer down, insert it into the goat's rectum, and leave it for 3 minutes. Compare the sick goat's temperature to normal goat physiological data (above).
4. Place your fist, palm, or fingertips on the left flank and feel for rumen movements. Also note if goat reacts as if in pain. If the rumen feels slushy or water-filled, this should be noted.
5. Place fingertips on both sides of lower rib cage and feel for the heart rate. Count heartbeats for 1 minute. The pulse may also be taken by feeling the big artery on the inside of the upper rear leg.
6. Roll back the eyelids and lips of the mouth to observe color of mucous membranes. Pink is normal, except when dark skin colors extend into the mouth. The color of the inside of the lips of the vulva also may serve as an indicator of paleness.
7. Feel over the goat's body to locate swellings and/or signs of pain.
8. Check for blindness. Move a hand toward the eye, but do not fan the air because a blind goat will blink if it feels air movement. If the hand is moved straight toward the eye, blinking will occur only when the goat can see.
9. Note any unusual sounds. Wheezing or coughing could indicate a respiratory problem. Grinding teeth or grunting indicate general body pain, either in the chest or abdomen.
10. Check all body openings to see if the goat has diarrhea, excessive salivation, a runny nose (note whether the discharge is clear or cloudy), and crusty or runny eyes.
11. When examining a lactating doe, always check the udder. Look for clots or bloody milk. Feel for hard knots, heat, or signs of a painful udder.

12. To detect abnormal sounds of the abdomen and chest areas of a goat, a stethoscope should be used. If one is unavailable, place your ear against the goat's chest or abdomen and listen.

Having made notes of the abnormal signs that you have observed, you can turn to the Diagnostic Guides that follow this section. Check your notes against these Guides. The symptoms that you have noted will probably fit closely with some of the general symptoms described by the Guides. You should now have reduced the number of possible diseases. To narrow the number even further, read the detailed description of each disease that you have identified as a possible cause.

### **Using the Guides and Disease Descriptions: An Example**

Your goat is 7 to 8 months old. Its temperature is 40C (104F). The goat is thin and has a watery diarrhea. Although it has not eaten well for several days, it does not appear dehydrated. The pulse rate is 85 and respiration 22 times per minute. The goat has a swelling under its chin and its eyes are pale. Therefore, major symptoms include diarrhea, increased respiration rate, increased heartbeat, no fever, and poor appetite.

Now turn to the Diagnostic Guides. Guide 3 deals with diarrhea and loss of appetite. Reading down the Guide, we can pick out specific diseases that seem to fit the symptoms. For this example, we can use: Acidosis, Bloat, Internal Parasites, Peste Des Petits Ruminants, Rift Valley Fever, and Salmonellosis.

In the Diseases section, we find more specific descriptions of the symptoms and the diseases. We can begin to eliminate some of the possible causes:

Acidosis: Goats with this disease usually have severe dehydration, do not appear pale, and do not have swelling under chin; therefore, eliminate as possible cause.

Bloat: Stomach is not full, the goat's eyes are pale, and it has swelling under its chin. Eliminate.

Internal Parasites: Fits most symptoms; probable cause--note for future use.

Pestes Des Petit Ruminants: We would consider only in world regions one, two, six, or seven. Also, animal has no raw areas in the mouth. Eliminate as cause.

Rift Valley Fever: We would consider only in world region one. Also, we found no sores on tongue and on cheeks inside the mouth. We have no indication of high death loss in young kids. Eliminate as cause.

Salmonellosis: No blood in stool; there is swelling under the jaws; normal body temperature. Consider as second choice.

Due to the normal body temperature and no mention of death loss, salmonellosis would fall as the second most likely choice. We would select internal parasites as the most likely cause of the symptoms.

The next step is to turn to the table on drugs (Therapy) to select one for the general treatment of internal parasites, probably thiabendazole. Determine the form in which the recommended product is available. In this case it is a liquid, to be given orally. Now go to the Techniques section for instructions on drenching the animal and equipment needed.

**Final Note:** Always seek professional veterinary help if available; symptoms of many diseases are very much alike and require laboratory tests or more training than we can provide in this handbook. Also read the complete description of the disease. It could be important to human health.



**Diagnostic Guide 1: Nervous System**

Disease	Causative agent	Page	Symptoms				
			Convulsions	Blindness	Head pressing	Circling	Other signs
Caprine arthritis encephalitis (CAE)	V	45	No	No	No	No	Very young are weak in rear legs. No fever. Progressive weakness until death.
Enterotoxemia	B	28	Yes	Usually not	Sometimes	Sometimes	Usually affects younger animals less than 1 year old. Very depressed. Head pulled back. Grinds teeth. Usually fatal.
Heartwater	P	67	Yes, after 1 or 2 days	No	Yes	Yes	Fever. Twitching eyelids. Tongue out. Very depressed. Affects all ages. Few die if treated.
Listeriosis	B	31	Yes	Yes	Yes	Yes	Fever. Head pressing. Drooping ear. Tongue out. May abort if nervous symptoms develop. Usually fatal.
Melioidosis	B	37	No	No	No	No	Jerking, trembling movements. All ages affected. Few die.
Omphalophlebitis (Navel ill)	B	38	Yes	No	Sometimes	Sometimes	Fever. Enlarged navel stump (if very young). May be depressed with a poor appetite. 50% to 60% die.

B = bacterial; V = viral; M = metabolic; P = parasitic.

Diagnostic Guide 1: Nervous System (continued)

Disease	Causative agent	Page	Symptoms				
			Convulsions	Blindness	Head pressing	Circling	Other signs
Polioencephalomalacia	M	62	Yes	Yes	Yes	Yes	No fever. Young animals show muscle tremors, grind teeth, roll eyes, no appetite. Respond well if treated.
Rabies	V	50	Yes	No	Maybe	Maybe	Fever. May be very excited or very depressed. Strange bleat. Chews on objects. May be very aggressive or dumb acting. All ages are affected. Always fatal.
Scrapie	V	52	No	No	No	No	Excited in early stages. Severe itching. Eats well. Suspect only when goats have been in contact with infected sheep. Incubation period will run from 1 1/2 to 5 years.
Tetanus	B	43	Yes	No	Maybe	Usually not	Sawhorse appearance. Excited and stiff when touched. Fever. No appetite. Usually associated with a wound about 2 weeks old.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 2: Diarrhea and Loss of Appetite, Young Animals (Under 4 Months)**

Disease	Causative agent	Page	Symptoms			
			Dehydration	Pulse rate	Respiratory rate	Other signs
Coccidiosis	P	70	None	Normal	Normal	Diarrhea, may be bloody. May see sudden death with or without diarrhea.
Colibacillosis	B	25	Severe	Normal	Normal	Dry mouth. Stomach full of gas. Usually fever. High death loss unless treated.
Colostrum deprivation (Hypogammaglobinemia)	M	58	Some	Normal	Normal	Dry mouth. Fever. May have swollen joints, enlarged navel stump, weakness. Most die.
Enterotoxemia	B	28	None	Normal	Normal	Full stomach and fever, usually.
Internal parasites	P	70-76	None	Increase	Increase	May have swelling under chin, paleness, severe weakness. May see sudden death before diarrhea develops.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 3: Diarrhea and Loss of Appetite, Older Animals (Over 4 Months)**

Disease	Causative agent	Page	Dehydration	Pulse rate	Respiratory rate	Symptoms
						Other signs
Acidosis	M	55	Severe	Weak	Increased	Full-stomach, watery contents. Diarrhea (watery, bad smell). Very weak. May not be able to stand. No rumen movement.
Bloat	M	57	None	May increase	Labored	Full stomach with gas or froth. Diarrhea develops after 24 hours.
Coccidiosis	P	70	None	Normal	Normal	Acute diarrhea usually with signs of blood. Severe straining.
Enterotoxemia	B	28	None	Normal	Normal	Full stomach and fever, usually. Sudden death common.
Internal parasites	P	70-76	None	Increased	Increased	May have swelling under chin, paleness, severe weakness. May see "sudden death" before diarrhea develops.
Nairobi sheep disease	V	48	None	Normal	Increased	Fever. Runny nose. Bright green diarrhea with some blood. Abortion.
Peste des petits ruminants (PPR)	V	49	None	Increased	Increased	Fever. Raw, red areas around mouth.
Rift Valley fever	V	51	None	Rapid, weak	Increased	Fever. Sores on cheeks and tongue. Abortion. High death loss in young kids.
Salmonellosis	B	41	Yes	Rapid	Increased	High fever. Bloody diarrhea or yellow or green diarrhea.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 4: Blood Loss and Paleness of Mucous Membranes**

Disease	Causative agent	Page	Symptoms			
			Red urine	Yellow membranes	Pulse	Other signs
Anaplasmosis	P	66	No	Yes	Rapid and weak	Slight fever. Poor appetite. Constipation.
Anthrax	B	20	Yes	No	Rapid and weak	Milk may be bloody. Bleeding from body openings. Death in 24 to 48 hours.
Babesiosis	P	67	Yes	No	Rapid and weak	Slight fever. Poor appetite. Bloody diarrhea, dark red urine.
Coccidiosis	P	70	No	No	Usually not affected	Acute, bloody diarrhea. Weak. Severe straining.
Internal parasites	P	70-76	No	No	May be rapid and weak	Good appetite (usually) until symptoms are very severe. Diarrhea (usually).
Trypanosomiasis	P	68	No	No	May be rapid and weak	Depressed appetite. Chronic weight loss, poor condition.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 5: Hard Breathing, Fever, and Poor Appetite**

Disease	Causative agent	Page	Symptoms			
			Pulse rate	Nasal discharge	Cough	Other signs
Anthrax	B	20	Fast, weak	Bloody	No	Bleeding from body openings. Death within 24 to 48 hours.
Contagious caprine pleuropneumonia	B	27	Fast	Runny, clear to pus	Yes	Tongue out. Raspy sounds from lungs. Sudden death (rarely).
Melioidosis	B	37	Fast	Thick, crusty pus	No	Skin abscesses.
Peste des petits ruminants (PPR)	V	49	Fast	Dry-clear	Sometimes	Raw areas in mouth. Develops pneumonia.
Pneumonia (all types)	B, V, P	40	Fast	Runny, clear to pus	Yes	Tongue out. Rapid exaggerated movements of ribs, raspy sounds from lungs. Grunting, groaning, and grinding teeth from pain.
Sheep/goat pox	V	53	Normal	Runny, clear to pus	Usually not	Scabs over body that leave scar (pit). Develops pneumonia.

B = bacterial; V = viral; M = metabolic; P = parasitic.

## Diagnostic Guide 6: Lameness and Poor Appetite

Disease	Causative agent	Page	Symptoms			
			Joints swollen	Age	Recovery	Other signs
Brucellosis	B	21	Sometimes	Adult, any age	Sometimes	Appetite good. May see repeat breeding in does; swollen testicles in males. Abortion.
Caprine arthritis encephalitis (CAE)	V	45	Yes	Adult	No, chronic	In young kids, central nervous disease symptoms, with good appetite, and no lameness or or swollen joints.
Colostrum deprivation (Hypogammaglobinemia)	M	58	Yes	Up to 2 months	Not common, 80% die	Diarrhea. Large navel stump. Fever.
Contagious agalactia	B	26	Yes	Adult and kid	With treatment	Severe mastitis in adults. Eye infection, fever, and sore joints in kids.
Foot and mouth disease	V	47	Usually not	Any age	Very slowly	Small blisters and erosions between toes, teats, and mouth. Raw areas. Fever. Degree of sickness varies with type of virus.
Foot rot	B	29	Usually not	Any age	With treatment	Foot swollen, smelly, rotten.
Mastitis	B	33	No	Adult female	With treatment	Swollen, hot, painful udder. Fever.
Melioidosis	B	37	Yes	Any age	Usually	Skin abscesses.
Omphalophlebitis (Navel ill)	B	38	Yes	Very young	With prompt treatment	Central nervous system symptoms and convulsions. Usually involves 1 or 2 joints. Hot, pus-filled navel stump.

B = bacterial; V = viral; M = metabolic; P = parasitic.

Diagnostic Guide 7: Inability to Stand

Disease	Causative agent	Page	Symptoms		
			Age of animal and time of occurrence	Attitude	Other signs
Colostrum deprivation (Hypogammaglobinemia)	M	58	First 3 weeks after birth	Convulsion or flat on side, may jump when touched	Fever. May press head or circle. Enlarged joints. Large navel stump.
Grass tetany	M	59	6 months and older (grazing new growth, lush grass)	May be aggressive	Trembling, some bleating. May appear after fertilization of pasture with potash in cool, wet weather. No fever.
Milk fever	M	60	Adult (1 week before and after kidding)	Very passive, head on side, no control over muscles	Subnormal temperatures. May appear as general muscular weakness and trembling before going down.
Pregnancy toxemia (Ketosis)	M	63	Adult (3 weeks before kidding)	Legs may be stretched behind them	May lose muscle control. Poor appetite. Most die unless they kid. No fever.

B = bacterial; V = viral; M = metabolic; P = parasitic.



Diagnostic Guide 8: Scabs or Scales on Skin

Disease	Causative agent	Page	Description and location of lesion	Symptoms
				Other signs
Contagious ecthyma	V	46	Thickened areas on gums, around mouth, or on teats	Depression, fever, poor appetite. Usually affects kids. Kids may show symptoms on rear leg. Affected does commonly develop mastitis.
Papillomatosis (warts)	V	48	Rough protrusions from skin	Warts fall off in about 6 months. Different type found on teats.
Ringworm	P	78	Rough circular areas all over the body	Sometimes occurs on udder. No fever. Normal appetite. Diffuse lesions may occur over the body.
Sheep/goat pox	V	53	Scabs over body that leave a scar (pit)	Scabs are more visible in areas having short (or no) hair. No appetite, depression. Very sick.
Streptotricosis (Dermatophilosis)	B	42	Thick crusty scabs matted in the hair over body	Yellow pus under scab--leaves raw, granular pit that may bleed.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 9: Abscesses or Infected Spots on the Skin and Body**

Disease	Causative agent	Page	Description and location of lesion	Symptoms
				Other signs
Caseous lymphadenitis	B	23	Large knots and abscesses located on body at lymph nodes, (see figure 12)	Fever (sometimes), usually in adults. May show chronic debilitating form (wasting).
Malignant edema	B	32	Spots of severe infection at a wound. Swollen and sore. Red streaks outward from spot.	Fever. No appetite. Very ill. Fatal if not treated.
Mastitis	B	33	Hot, hard, painful udder; may be black with dead tissue. Consistency of milk changed.	Fever. May show lameness. May have poor appetite.
Melioidosis	B	37	Abscesses on body and swollen joints	May appear as pneumonia. Fever. Coughing. Staggering. Poor appetite.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 10: Itching and Hair Loss**

Disease	Causative agent	Page	Age	Symptoms	
				Death	Other signs
Allergies/insect stings	M	56	All ages	If animal dies, it is usually within first 15 minutes.	Bumps over whole body. Shock. Weakness. Trembling. Thickened skin. May not show hair loss.
Scrapie	V	52	Affects 2 to 6 year-old goats	100% death loss	Normal appetite. No fever. Very poor condition. Slow death (6 months).
Ticks, flies, and other pests	P	79	All ages	Screwworms and severe infestations can cause death.	Bloody areas. Anemia. Infections where bitten.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 11: Spontaneous Abortion**

Disease	Causative agent	Page	Symptoms			
			When abortion occurs	Death in doe	Other areas of body involved	Other signs
Brucellosis	B	21	Final 50 days of gestation	Rare	Joints sometimes swollen	Slightly reduced appetite.
Chlamydial abortion	B	24	Final 50 days of gestation	Rare	None	May not keep up with herd. Slightly reduced appetite. High percent of herd will abort.
Foot and mouth disease	V	47	Early in disease	Recover very slowly	Mouth, feet, teats	Fever. Increased pulse rate. No appetite.
Listeriosis	B	31	At any time (may be only symptom)	Rare (when abortion occurs)	Ears drooped, tongue out, head press	No appetite. Circling. Death common when central nervous system involved.
Nairobi sheep disease	V	48	During sickness	Rare	None	Fever. No appetite.
Rift Valley fever	V	51	During sickness	About 20%	Sores on tongue and cheeks	Fever. No appetite. Rapid and weak pulse. Mortality--90-100% in kids under 1 week old, 20% over 1 week old.
Salmonellosis	B	41	Final 50 days of gestation	About 30%	Diarrhea, intestinal lesions	Fever. No appetite.
Toxoplasmosis	P	76	Final 50 days of gestation	Rare	None	None.

B = bacterial; V = viral; M = metabolic; P = parasitic.

**Diagnostic Guide 12: Carcass of Diseased Animal (No More Than 6 to 8 Hours After Death)**

Disease	Causative agent	Page	Symptoms						
			Bloat	Stiffness of limbs	Gas under skin	Blood from body openings	Membranes pale	Membranes yellow	Sudden death
Anaplasmosis	P	66	Usually not	Yes	No	No	Yes	Maybe	No
Anthrax	B	20	Yes	No	Maybe	Yes	No	No	Yes
Bloat	M	57	Yes	Yes	Yes	Maybe	No	No	Yes
Enterotoxemia	B	28	Yes	Yes	No	No	No	No	Yes
Internal parasites	P	70-76	Usually not	Yes	No	No	Yes	Maybe	No
Malignant edema	B	32	Usually	Yes	Yes	Maybe	No	No	Maybe
Polioencephalomalacia	M	62	Maybe	Yes	No	No	No	No	Maybe

B = bacterial; V = viral; M = metabolic; P = parasitic.

## **BACTERIAL DISEASES: CAUSES, TREATMENTS, AND PREVENTION**

Any disease caused by the invasion of the body by a bacteria is a bacterial disease. Bacteria may enter alone or following insult to tissue either by viral infection, trauma, or stress. Most will respond to proper antibiotic therapy.

### **Anthrax**

(Splenic Fever, Charbon, Milzbrand)

#### **Symptoms**

Anthrax is marked by high fever, 41.5C (107F), severe depression, dark red to purple lining of the mouth and eyes, and sometimes bloody diarrhea. Breathing is rapid and shallow; heartbeat is rapid and weak. The goat has no appetite and its milk or urine is red or blood-tinged. The tongue, throat, flanks, and area around the anus and vulva show swelling (edema).

In the dead animal, it is common to observe blood seeping from the body openings and a lack of stiffness in the carcass. If you suspect death by anthrax, **do not open the carcass**. Rather, you should remove one of the goat's ears, place it in a plastic bag (cooled if possible), and take it quickly to a veterinarian or a diagnostic facility for a diagnosis. Microscopic examination of blood from the ear can confirm the diagnosis. If the carcass is opened, the blood does not clot and usually the spleen is greatly enlarged.

#### **Cause/Transmission**

The bacterium *Bacillus anthracis* changes from an actively growing vegetative form in the body to spores or inactive forms when the organism comes in contact with air. When spores are swallowed by the animal, the organism changes back to the vegetative form and starts growing.

The spores are spread animal-to-animal and by animals eating feeds contaminated by spores, i.e., by grazing on contaminated ground, drinking contaminated water, or eating unsterilized animal by-products such as bone meal or poorly cooked meat scraps. The disease in goats is usually peracute

(kills the animal in 2 to 6 hours) or the acute form, which takes up to 48 hours for death to occur.

### **Treatment and Prevention**

After symptoms fully develop, treatment is usually not effective. If an outbreak is underway, all other animals in the area should be treated and vaccinated. Vaccination with spore vaccine is usually under the direction of agriculture department personnel. Treatment is with tetracyclines or penicillin in large doses for at least 5 days (see Therapy).

Spread is prevented by burning or deeply burying the **unopened** carcass. Only very strong disinfectants will kill spores. They are not killed by hot or cold weather or by drying and can live in the soil for many years. However, if the carcass of an animal killed by anthrax is buried unopened, rotting and lack of oxygen will prevent spore formation and kill the organism. Totally burning the carcass will also destroy the organism. Vaccination is recommended for animals in areas where anthrax reoccurs regularly.

### **Human Health Concerns**

Anthrax is a **very serious** disease of both animals and man. A skin form known as malignant carbuncle or malignant pustule can be very serious. You may contract the disease when handling infected animals or fluids or parts of dead animals. An intestinal form contracted by eating infected meat is nearly always fatal to humans, as is a pneumonic form contracted by breathing spores from handling wool and hides of infected dead animals.

### **Brucellosis**

(Bang's Disease, Malta Fever, Contagious Abortion)

### **Symptoms**

Goats show only vague symptoms including occasional mastitis, lameness of feet, or slightly loose stool. Does may abort in the final 4 to 6 weeks of pregnancy. The male may show swollen

joints or testicles. A blood test is the best method of diagnosing brucellosis in goats, usually done by a veterinarian or in a diagnostic laboratory. Brucellosis is often traced to goats when found in humans.

### **Cause/Transmission**

Although there are other species of *Brucella*, *Brucella melitensis* is normally the only one that affects goats. The disease spreads when goats eat contaminated feed or lick infected material from the reproductive tract, newborn kids, or around the external reproductive organs of the infected doe. The organism also is transmitted to humans who handle these infected materials, drink infected raw milk, eat infected uncooked milk products, or assist with the birth process of infected does.

### **Treatment and Prevention**

No treatments are effective. Usual recommendations are that infected does and their kids be slaughtered for meat. The best prevention is buying uninfected animals. In some countries where infection is common, a vaccine is used to control spread of the disease.

### **Human Health Concerns**

Brucellosis is a high risk disease. You should not drink uncooked or unprocessed milk or milk products. See the section on Mastitis for milk processing procedures. Do not handle or assist in the birth process of infected female animals without protecting your hands and arms with rubber or plastic gloves. Wash with soap and water after assisting. Slaughtering or eating meat from infected animals is not dangerous if minimum sanitary measures are followed and the meat is cooked.

Brucellosis in humans should be suspected when a recurrent flu-like syndrome is observed, along with high fevers and sweats that recur on a daily basis, especially if the person has been drinking milk that has not been boiled or pasteurized. These symptoms are accompanied by weakness and vague body aches and pains. Improvement is noticed in about 2 weeks, with symptoms recurring a few



days to 2 weeks later for extended periods of time.

### **Caseous Lymphadenitis** (Pseudotuberculosis, Abscesses)

#### **Symptoms**

Swollen, abscessed lymph nodes occur most commonly under the jaw and ear, in front of the shoulder, high in the flank, or above the udder, scrotum, or hock. The nodes may feel warm, and may swell to 3 to 5 cm (1 1/2 to 2 in.) or larger. The disease is seldom fatal, unless involving a major artery or nerve around the head, or the lymph nodes inside the body. The abscesses contain a characteristic cheesy, greenish-colored pus. Diagnosis is based on the locations of the abscesses, the character of the pus, and microscopic culture examination, if available. This is a very common disease in agriculturally developed countries.

#### **Cause/Transmission**

Although normally contracted when goats eat contaminated feeds, it might also be contracted via breaks in the skin. There is even some evidence that bacteria can enter unbroken skin.

#### **Treatment and Prevention**

Abscesses are treated by surgical lancing (see Techniques) or total removal by a veterinarian. Additional treatment by administration of antibiotics, usually penicillin or a tetracycline, should be continued for 3 to 5 days.

Caseous lymphadenitis is difficult to prevent due to the fact that *Corynebacterium pseudotuberculosis (ovis)* is a very common soil contaminant. Spread can be slowed by carefully lancing abscesses and washing the wound with 7% iodine. All material from the abscess should be deeply buried or burned. All new additions, especially those imported from agriculturally developed countries, should be held in isolation, away from local goats, for at least 30 days and preferably 90 days. This gives them a chance to develop symptoms of this and other longer incubating diseases before being mixed with

local goats. A killed vaccine made from the organism of an infected herd has been reported as a successful prevention procedure.

### **Human Health Concerns**

Humans should protect their hands from the pus as the organism could cause skin infection. Wash hands well after handling infected animals.

### **Chlamydial Abortion** (Enzootic Abortion)

#### **Symptoms**

Abortions occur late in pregnancy (usually one of the first three pregnancies). Later deliveries are normal. Kids may be carried full term but delivered stillborn (sometimes as a mummified fetus) or in a weakened condition. Retained afterbirth is common after abortions. The doe seldom suffers any aftereffect unless she gets a uterine infection from a retained fetus or afterbirth. Large numbers of does in newly infected herds abort. Chlamydial abortion can be positively diagnosed only by culture of the aborted fetus or membranes or by a blood test done in a laboratory.

#### **Cause/Transmission**

The *Chlamydia psittaci* organism is more common in sheep but has also been reported in several severe outbreaks of abortion disease in goats. It is thought that females or offspring may become infected by swallowing the organism during the kidding season, with the organism delaying growth in the doe until late in the following pregnancy.

#### **Treatment and Prevention**

The use of tetracycline drugs given intramuscularly for 5 to 7 days has been reported to help in decreasing the number of abortions by reducing the spread of the organism to uninfected goats. Feeding the oral tetracyclines at 110 to 165 g/metric ton or 110 to 165 mg/kg of feed has also helped control this disease. Those fetuses already infected, however, will abort regardless of treatment. The best way to keep the disease from

spreading is to burn or bury the dead kid and tissues from the birth process and to isolate aborting does from the rest of the herd. In some countries, a vaccine has been developed that seems to work quite well when given 1 month before breeding the goats.

### **Human Health Concerns**

None

### **Colibacillosis**

(Scours, Diarrhea, White Scours, Yellow Scours)

#### **Symptoms**

Severe depression, weakness, and watery diarrhea are symptoms of colibacillosis. Rapid dehydration is evidenced by skin that stays up when pinched and the eyes sinking into the head. Skin is cold and clammy. Many causes of scours in kids can have the same or similar symptoms. Kids will die quickly unless lost fluids and electrolytes (body salts) are replaced. Diagnosis is based on the symptoms and can be confirmed by laboratory culture procedures.

#### **Cause/Transmission**

The bacterium *Escherichia coli* causes the disease in very young kids (newborn to 2 weeks) and is usually related to dirty surroundings. *E. coli* is very commonly found and some types of the organism are more likely to cause disease than others. Outbreaks rapidly worsen unless strict sanitation procedures are begun. The organism is taken in by mouth, usually very soon after birth. Lack of adequate colostrum usually contributes to colibacillosis. See the section on care of the newborn.

#### **Treatment and Prevention**

You should 1) replace fluid loss, 2) correct electrolyte balance, and 3) kill the organism with antibiotics. Replace the milk given to the kid with any of the formulas listed in the Therapy Section under Treatment for Scours. The appropriate amount is 10% of body weight, needed for daily usage or maintenance, plus the percentage lost due to dehy-

dration. Start the kid on an oral antibiotic, such as neomycin, spectinomycin, chloramphenicol, tetracycline, or a sulfa drug at about 5-10 mg/kg of body weight, twice daily. Always follow label direction on drugs.

Kids are born with no immunity and must receive colostrum from their mothers to become resistant to disease. Feeding the kid well with colostrum before it is 2 hours old will protect it until it is old enough to build its own disease defense mechanism. After the first 12 hours of life, the kid's ability to absorb these antibodies decreases rapidly and is gone by the time the kid is 24 hours old. Clean surroundings also are important to prevent this disease. Kids should be born in clean or unused areas and kept warm and dry, but not necessarily in a closed building.

### **Human Health Concerns**

None

## **Contagious Agalactia**

### **Symptoms**

Fever and loss of appetite are seen in all three types. Other symptoms may include: (Type 1) acute mastitis exhibited as a hot, painful udder producing a greenish-colored, cheesy, pus-like material (chunks) and a watery fluid, with the udder drying up in long-term cases; (Type 2) a cloudy cornea of the eye that may proceed to an ulcer and blindness, although complete recovery usually occurs quickly; and (Type 3) an arthritic form with hot, painful, swollen joints that sometimes rupture as an abscess, where the animal may not be able to stand if more than one joint is involved. Diagnosis is confirmed by laboratory procedures and blood tests.

### **Cause/Transmission**

Contagious agalactia is a disease of sheep and goats caused by *Mycoplasma agalactia*. The organism is found in milk, urine, feces, and eye and nasal fluids for several months after infection. Spread-

ing may occur when an uninfected goat contacts these secretions.

### **Treatment and Prevention**

Helpful antibiotics are tetracycline or tylosin given intramuscularly (see Therapy and Techniques). The death rate can reach 20% of the infected animals. A vaccine is available in some countries.

### **Human Health Concerns**

None

## **Contagious Caprine Pleuropneumonia (CCP)**

### **Symptoms**

Severe pneumonia symptoms may involve only one lung. Of exposed animals, many become sick and a high percentage die. Recovery requires a long time. Laboratory diagnosis will confirm the disease.

### **Cause/Transmission**

Contagious caprine pleuropneumonia is caused by *Mycoplasma sp.* and is commonly seen in Africa, Asia, the Mediterranean, and has been reported in Mexico. The disease is spread by contact with an infected animal.

### **Treatment and Prevention**

Early treatment with tetracyclines or tylosin will help reduce death loss in infected animals (see Therapy and Techniques). Prevention by using vaccines has been reported to be of value. Vaccines are usually available in countries where CCP is found.

### **Human Health Concerns**

None

## **Enterotoxemia**

(Type C: Struck, Lamb/Kid Dysentery)

(Type D: Pulpy Kidney Disease, Overeating Disease)

### **Symptoms**

Symptoms include star gazing (upward lift of the head), convulsions, tooth grinding, twitching, and death within a few hours. Sometimes the goat will have diarrhea, which may or may not be blood stained. The rumen motility will stop. Kids are often found dead. Postmortem symptoms include fluid in the heart sac, which usually contains a clot that looks like chicken fat. Blood free in the intestine is also sometimes seen. A urine test for sugar will usually be positive. Urine test strips used by diabetics can serve for this test, but complete diagnosis should be made in a diagnostic laboratory.

### **Cause/Transmission**

Types C (struck and lamb dysentery) and D (pulpy kidney disease and overeating disease) of the bacterium *Clostridium perfringens* are usually involved. Type C seems to affect the very young and older adult animals, with Type D affecting those from 3 to 4 weeks old to about 1 year. The organism lives in the soil and normally is found in the stomach and intestines of sheep and goats. The disease is triggered by changes in the normal rate of passage of feed through the gut. For example, a change in the type of feed or overfilling the stomach (such as a kid drinking an excessive amount of milk) may allow the organism to grow. A toxin is produced by the fast growing bacteria, and the absorption of this toxin causes the symptoms of the disease.

### **Treatment and Prevention**

Treatment of affected animals is not successful unless the specific antitoxin is available. Intravenous or subcutaneous administration of the antitoxin will usually reverse the seizures. Antibiotics (penicillin) will usually stop the growth of the bacteria but do not affect the toxin that has already been produced and absorbed. If anti-

toxin is not available, 115 to 170 g (4 to 6 oz) of powdered charcoal and 15 to 30 g of baking soda given by mouth may be helpful (see Techniques).

Only well-fed animals are affected by enterotoxemia, which can be prevented easily. Two doses of the vaccine (a toxoid) should be given to the doe: one dose at 4 weeks before she kids and another dose 2 weeks before she kids. Kids should be vaccinated after weaning with two doses, 2 weeks apart. One booster shot each year thereafter will protect the doe and her subsequent kids until they are weaned (see Therapy).

### **Human Health Concerns**

None

## **Foot Rot**

### **Symptoms**

Lameness is the first foot rot symptom. The sole and the sidewall of the diseased foot appear ragged and rotten and have an extremely bad odor.

### **Cause/Transmission**

Caused by the invasion of two bacteria, *Fusobacterium necrophorus* and *Fusiformis nodosus*, the disease is usually spread from infected carrier animals into the soil and then to the noninfected feet. Goats do not develop the condition as readily as do sheep. Wet soils and filth increase the possibility of disease outbreaks.

### **Treatment and Prevention**

Remove the dead, rotten foot tissue with shears or a sharp knife (see Techniques). Trim down until healthy tissue is found. Some bleeding will occur. This is necessary to remove the diseased tissue. Spraying the area with a solution of chloramphenicol or 10% formalin, or forcing the animals to walk through a 10% formalin, copper sulfate or zinc sulfate foot bath can be beneficial (see Therapy). The foot bath should be placed so that the goats must pass through it as they go to graze or to be milked. Do not place the bath where goats are likely to drink from it.

The best method of prevention is to remove animals from dirty and wet areas for about 4 weeks so the organisms in the soil will die out or decrease in number. Regular trimming of the feet will also help prevent this and other foot problems. Do not buy animals from infected herds.

### **Human Health Concerns**

None

### **Johne's Disease** (Paratuberculosis, Wasting Disease)

#### **Symptoms**

Johne's disease is usually seen in animals 3 to 5 years old. Symptoms include progressive loss of weight, rough hair coat, decrease of milk production, decreased appetite, and progressive depression. A diarrhea will develop within the last few days before death. Stress seems to trigger the disease or make it progress faster. The organism affects the area where the small and large intestine join together and interferes with the ability of the goat to absorb nutrients from the intestine. Usually only a few goats in the herd are involved.

#### **Cause/Transmission**

The disease caused by the bacterium *Mycobacterium johnei* is thought to spread through feed contaminated with the organism and must occur before the goat is 6 months old. There is some evidence that kids can be born with the disease or pick it up from the doe's milk or fecal contamination on the udder.

#### **Treatment and Prevention**

There is no effective treatment. Diagnosis can be made in a laboratory by finding and growing the organism. The IV Johnin test can be run in the field but requires some knowledge of the procedure and of how to make white blood cell counts.

As preventative measures, you should buy healthy animals and remove infected goats from the herd. Spread can be reduced by avoiding stress on



the animals. An experimental vaccine has been used in Iceland with good results. All imported goats should be tested and found negative before allowing entry into any country.

#### **Human Health Concerns**

None

### **Listeriosis** (Listerellosis, Circling Disease)

#### **Symptoms**

The abortion form usually shows no other symptoms. It can only be diagnosed by growing the organism from the aborted fetus in a laboratory. The nervous or encephalatic form has a rapid course and causes death in 4 to 48 hours after symptoms appear. Symptoms include circling in one direction, high fever, lack of appetite, red tissues around the eyes (maybe with blindness), and depression. Affected animals may have a paralysis of one side of the face, represented by a drooping ear, drooping eyelid, and saliva running from limp lips. Up to 20% of the goats in a herd may be involved. When near death, the animal will lie down and may have fits. Confirming diagnosis can only be made in a diagnostic laboratory.

#### **Cause/Transmission**

Listeriosis is caused by the bacterium *Listeria monocytogenes* and is commonly seen in cooler climates. The bacteria are very hardy and are found in soil, silage, manure, milk, urine, and drainage of the eyes and nose of infected animals. Listeriosis is spread when goats swallow, inhale, or get the bacteria in their eyes. The route by which it is spread can influence the symptoms. For example, swallowing the organism usually causes abortion, whereas infection through the eye or nose usually results in the nervous form. In developing countries it is most commonly seen when silage is put up too dry or not compacted tight enough to protect it from air.

## **Treatment and Prevention**

There are no effective treatments for small ruminants, and they usually die after infection. Large doses of penicillin may help in some cases. When an outbreak occurs, you should isolate infected animals. If silage is being fed, discontinue its use.

## **Human Health Concerns**

Listeriosis can cause **serious** diseases in humans. Be extremely careful when handling sick or dead animals. Do not eat any part or product of the sick or dead animal. Wash hands and disinfect clothes and shoes. Use all sanitary measures possible. If a herd is infected and milking animals have aborted, milk should be boiled or pasteurized before use. See the section on Mastitis for milk processing procedures. Pregnant women should avoid infected animals. Symptoms may range from a mild irritation on the hands and arms from assisting in the delivery of a kid to a severe blood poisoning disease. Encephalitis and abortion of pregnant women may also be produced by listeriosis.

## **Malignant Edema (Gas Gangrene)**

### **Symptoms**

A swollen and infected spot on the animal is accompanied by high fever, depression, and a lack of appetite. If the infection is a castration wound, the animal may walk stiffly. The swollen and infected area will spread rapidly. The best diagnosis is obtained by growing bacteria in the laboratory.

### **Cause/Transmission**

Although usually caused by the bacterium *Clostridium septicum*, other forms of *Clostridium* spp. could possibly cause the same kind of wound infection in goats. The disease starts when a cut or some other type of wound is contaminated with the bacteria. The bacteria grow and produce a poison that kills the muscles and tissues around the infection site. Death of the animal can occur very

rapidly or over 2 to 3 days depending on how much tissue is killed and where the infection is located.

### **Treatment and Prevention**

Treatment with penicillin, tetracycline, or most any antibiotic or sulfa drug will kill the bacteria if started very early in the disease (see Therapy and Techniques). However, many animals infected with malignant edema die because of delay in treatment.

The best prevention is care and cleanliness when castrating or dehorning goats. Any other injury should be carefully cleaned and antibiotic or sulfa powder applied to the wound.

### **Human Health Concerns**

Human wounds can become infected with *Clostridium septicum*. Wash your hands very well after handling infected wounds and apply a small amount of antibiotic or sulfa powder to any cuts or scratches on your hands.

## **Mastitis**

### **Symptoms**

Regardless of cause, the symptoms of all types of mastitis are heat, pain, and swelling of the udder. Usually you will note some discoloration of the tissue and abnormal milk. The infected udder will change in color from slightly more pink to a bright red, or to a black and cold udder, indicating gangrenous mastitis. Gangrenous mastitis usually kills the doe and the udder is always destroyed even if she recovers. The milk from an infected udder will vary in color, texture, and thickness depending on the type of organism involved. Milk may be almost normal in all respects, or may be watery and pale, dark yellow and thick, chunky and greenish, or bloody. Almost any combination can occur.

The California Mastitis Test (CMT) is commercially available in most countries and has been recommended as a good test for subclinical mastitis. You should be cautious in using the CMT

because many normal, healthy goats will show a milk reaction to this test. Very marked reactions do indicate mastitis problems, however.

Laboratory culture or growth of the bacteria causing the mastitis is the best way to determine the exact diagnosis. Antibiotic sensitivity tests also can be run to determine the correct antibiotics to use.

### **Cause/Transmission**

Mastitis is an inflammation of the mammary gland (udder or milk-giving gland) of animals, usually caused by bacteria. *Staphylococcus spp.*, *Corynebacterium spp.*, *Streptococcus spp.*, or coliforms cause over 95% of all cases. Mastitis is usually characterized as clinical when symptoms are present or subclinical when symptoms appear periodically. In the latter case, the gland is still infected during periods when no symptoms are present. The subclinical type will usually reduce total milk production by at least 25%. Causes, though varied, are most commonly rough treatment and unclear milking practices. Several diseases will cause a decrease in the production or appearance of the milk. Injury to the udder by boards or posts can cause mastitis, as can fighting between goats. Trauma or rough handling when hand milking can injure the udder and cause mastitis. Milking machines require extreme care and caution: improperly adjusted or dirty machines will cause mastitis. If you suspect a machine malfunction, it should be checked and serviced by a qualified technician.

### **Treatment and Prevention**

Several products are almost universally available for intramammary infusion (to be put into the teat). These products are antibiotics or combination of antibiotics in a 10 to 15 cc dose and are packaged in a plastic throwaway tube to inject into the teat. When using one of these products, always wash the teat end with soap and water and wipe with alcohol before sticking the applicator into the teat. You should not reuse applicator or divide a dose between two teats (see Techniques).

### Special Aid to Mastitis Diagnosis

Organism	Symptoms seen	Drug of choice
<i>Staphylococcus</i> spp. Hemolytic type	Gangrenous mastitis; hard, black, cold udder; may drip blood-tinged liquid. The tissues are dead and will fall off.	Penicillin Ampicillin
<i>Staphylococcus</i> spp.	Usually nonclinical type. Very CMT positive. Gradual destruction of milk-giving tissues. Develops hard lumps in udder.	Penicillin Ampicillin Cloxicillin
<i>Streptococcus</i> spp.	Swelling and tenderness. Either no change in milk or small white flakes and watery milk. Temperature 40-41C (104-105F). May have repeated attacks.	Penicillin Ampicillin Tetracyclines
<i>Corynebacterium</i> spp.	Large lump high in groin above udder and visibly swollen. Thickened milk. Abscesses may develop in the udder. Reduced volume and watery milk sometimes occur.	Penicillin Tetracyclines (animals do not respond well)
<i>Klebsiella</i> spp. and other coliforms	Gland becomes extremely hot, red, and swollen with small amounts of clear, yellow fluid from udder. Often seen when sawdust or wood shavings are used for bedding.	See note below

**Note:** Several antibiotics will kill these bacteria; however, the toxins released from the dead bacteria and the damage done to the udder usually kill the goat. Nursing care and prolonged recovery are required.

Intravenous and intramuscular antibiotic injections should also be used in very serious cases. The udder should be milked out at least three times per day. Bathing the udder two or three times per day in warm water also will help to reduce some of the pain and swelling.

Prevention includes proper maintenance of equipment, if machine milking is practiced. Goats with mastitis should always be milked last. In addition, sanitation in preparation for the milking process is important. Wash the udder by hand, using clean, warm water. Soap may be needed if the udder is dirty. Do not use an old cloth to wash the udder, as it will hold bacteria that may be transmitted from goat to goat. Air dry the udder, if possible, or dry it with a paper towel or clean cotton towel. Milk the goat with clean and dry hands.

After milking, a very mild teat dip can be used. Dip about 3.5 cm (1 1/2 in.) of the end of the teat into a small cup of teat dip. You will have to experiment with teat dips to find one that does not cause chapping as many cow teat dips cause severe irritation to goats. Dip can be used on several (6 to 7) goats at one milking, but do not save dip from one milking until next, it could contaminate uninfected goats.

When the goat turns dry before the next kid is due (usually 2 months before), and if mastitis has been a problem in your herd, you should use a dry treatment on at least each previously infected goat. Several such dry treatment products are on the market. Those containing cloxicillin seem to work best. When the goat has been milked for the last time, wash the teat ends with soap and water, then sponge the opening with alcohol and insert the tip of the applicator into the opening. Inject the total amount of the tube into the teat, massage it carefully, and dip the teat in the teat-dip solution. Do not split the dose between halves of the udder.

Remove any objects around the farmstead that might cause udder injury, such as low branches or door openings that may hit the udder. If goats are fighting, they should be dehorned. Adults should

be dehorned only by a veterinarian because the horn base is very close to the brain. Kids can be disbudded (see Techniques) when a week or 10 days old. Most authorities do not recommend feeding mastitis milk to kids.

### **Human Health Concerns**

Some of the bacteria that cause mastitis can cause sickness in humans. Never use infected milk for human consumption, especially for babies. Do not use milk for human consumption for at least 3 days after animals are treated with drugs.

All milk should be pasteurized or boiled before being fed to babies or sick people. To pasteurize, place milk in a glass or stainless steel container. Rapidly heat the milk to 74C or 165F and hold at that temperature for 20 seconds while stirring.

Rapidly cool the milk to 15.5C or 60F and store it at 4 to 7C or 40 to 45F. If refrigeration is not available, boiled milk (just to a boil) will keep for about 1 day in a clean airtight container. Heating to 83.8C or 183F very quickly and letting it cool will also keep milk fresh for about a day.

### **Melioidosis**

(Whitmore's Disease, Human Glanders)

#### **Symptoms**

Symptoms of melioidosis are slight fever, loss of appetite, depression, labored breathing, coughing, runny nose. Joints, lymph nodes, and testicles are sometimes swollen. Occasionally abscesses will form and drain. Nervous symptoms sometimes occur, including staggering, jerky movements, or paralysis. Young animals are more commonly infected, but older animals also develop the disease. Diagnosis is made by observing symptoms and growing the bacteria in the laboratory. Some blood and skin tests have proven useful in diagnosing this disease.

### **Cause/Transmission**

Caused by the bacterium *Pseudomonas pseudomallei*, melioidosis is most commonly seen in Southeast Asia, but also occurs in most other areas of the world. Infection is due to the contamination of wounds with soil containing the organism. Spread from animal to animal or animal to man is unlikely.

### **Treatment and Prevention**

Treatment is usually unsuccessful. Older animals sometimes recover but may get sick again when under stress. If you do decide to treat, use tetracycline, chloramphenicol, or sulfa drugs (see Therapy and Techniques). No vaccine is available. As a precaution, healthy animals should be kept away from areas where the disease has occurred.

### **Human Health Concerns**

Although unlikely, human infection may occur as a result of swallowing the organism. Parts or products from infected animals should not be used for human food unless the animal recovers completely.

### **Omphalophlebitis**

(Navel Ill, Omphalitis, Joint Ill, Pyemic Arthritis, Polyarthritis)

### **Symptoms**

Symptoms of omphalophlebitis are high fever, depression, refusal to nurse, sometimes hot, painful joints, swollen and tender navel, and convulsions or fits. Symptoms usually occur quickly but may be delayed for more than a month. When delayed, the symptoms are usually seen as swelling and soreness of all joints, unwillingness to stand, some mild fever, and occasionally convulsive seizures (fits). The most common symptom observed is an enlarged and hard navel stump in a very young animal.

### **Cause/Transmission**

Numerous kinds of bacteria may enter the navel stump soon after the kid is born. The arthritic



form can also be caused by bacteria that enter castration or dehorning wounds. The organism grows and enters the blood stream (septicemia).

### **Treatment and Prevention**

If the condition is long-standing or the kid is 1 to 2 months old, treatment is of little benefit. Infections in the very young (under 2 weeks) will usually respond to injections of antibiotics --penicillin, chloramphenicol, tetracyclines, and sulfa drugs (see Therapy and Techniques). If the joints are involved, or the kid is having fits, chances of full recovery are poor.

Prevention is the best procedure. Clean surroundings, clean hands when delivering the newborn, and dipping the navel stump in 7% iodine work very well.

### **Human Health Concerns**

None

### **Pink Eye**

(Infectious Keratoconjunctivitis)

### **Symptoms**

Symptoms of pink eye are watering of the eyes, redness of the whites of the eye and eyelids, swelling of the eyelids, and squinting to keep the sun out. Later on, the cornea (clear part of the eye) becomes cloudy and blood vessels may grow across it. Sometimes an ulcer or a pit will develop on the cornea. The ulcer can rupture and cause blindness. The eyes will heal in 1 to 4 weeks, depending on cause and severity. In one type of pink eye, kids develop a high fever and severe lameness. This disease is not included in a guide.

### **Cause/Transmission**

Various organisms, including bacteria, viruses, rickettsia, and chlamydia, cause infections of the eye with symptoms that may be classed as pink eye. These organisms are transmitted by contact with infected goats or insects carrying the organisms from goat to goat, or by irritation from dust

or other sources that can cause scratches or injury to the eye.

### **Treatment and Prevention**

Injections of antibiotics, such as the tetracyclines or tylosin (see Therapy and Techniques), or use of eye ointments seems to help. Healing usually requires 1 to 4 weeks. Keeping the goat indoors or under a dense shade will help to reduce pain to the eyes. A patch over the eye can also be used to reduce sun glare. Keeping infected goats away from uninfected goats is the best prevention. No vaccines are available.

### **Human Health Concerns**

None

## **Pneumonia** (Lung Sickness)

### **Symptoms**

Symptoms are fever, runny nose, dry or wet cough, and changes in the rate and type of breathing (which may be shallow or labored). In severe cases, the goat will breathe through an open mouth. If the lungs are painful, the goat will not want to move and may grunt when breathing.

### **Cause/Transmission**

Pneumonia may be caused by many bacteria and viruses, as well as parasites (primarily lungworms) and allergic reactions. The broad term, pneumonia, is used to describe infectious or noninfectious causes of inflammation of the lungs. The disease may be very acute (causing sickness and death in a few hours) or chronic (continuing for years).

Pneumonia is usually caused by organisms in the goat's surroundings and begins with some type of stress. Probably the most common stress for goats is that caused by poor or no ventilation in their housing. Air flow to keep humidity low is very important in prevention of goat pneumonia. If you see moisture condensing in the shelter (small beads of water on the roof or pen) or smell ammonia, the ventilation is poor. By opening an area

near the highest part of the roof or along the side of the barn, you can remove much of the moisture by letting the wet, hot air escape from the building. Gases, however, may be heavier than air, and may have to be ventilated out through the bottom of the shelter. In most climates, a goat requires only a shelter from the rain, a windbreak, and adequate access to sunshine if they are to be stabled.

### **Treatment and Prevention**

Treatment consists primarily of good care, warm, well-ventilated (but not drafty) quarters in an area where the animal can be handled gently for treatment. Intravenous or intramuscular administration of antibiotics or sulfa drugs is necessary (see Therapy and Techniques). Fresh feed and water should be easily available to avoid unnecessary movement.

Available bacterial vaccines have not been very successful. Proper ventilation, moisture, and gas control are the most important aspects in preventing pneumonia in goats.

### **Human Health Concerns**

None

### **Salmonellosis**

(Bloody Scours or Black Scours)

#### **Symptoms**

A symptom of salmonellosis is blood-streaked or black tar-like diarrhea in young kids. The kids will have a high fever and may pass a material with the diarrhea that looks like the stringy lining of the gut. In Europe, one type of salmonella causes abortions in goats.

Diagnosis is best made from growing the bacteria in the laboratory. However, fairly reliable diagnosis can be made in a field situation. A postmortem examination done by a veterinarian is very helpful and highly recommended.

#### **Cause/Transmission**

Various types of the *Salmonella* bacteria cause salmonellosis in several species of animals. These

bacteria are very common in the environment and are spread by carrier animals that usually show no symptoms of the disease. They can be passed from animal to animal by contact when goats eat feed contaminated by the bacteria.

### **Treatment and Prevention**

Treatment with neomycin, tetracyclines, chloramphenicol or sulfas by mouth will be useful most of the time (see Therapy and Techniques). Encourage the goat to eat and drink by offering fresh, clean water and good fresh feed. Keep the sick goat as comfortable as possible and avoid chilling. To prevent salmonellosis, isolate infected animals, clean up the area carefully, including changing soil in small enclosures, and be careful not to buy animals from herds with a history of bloody scours. Keep the healthy kids away from sick goats after their recovery and clean the premises well.

There are vaccines available for specific types of salmonella. They are helpful if the type is known.

### **Human Health Concerns**

*Salmonella* spp. also may infect humans. Careful personal sanitation (washing hands after handling infected animals) is necessary to prevent contracting this disease.

### **Streptotricosis**

(Dermatophilosis, Strawberry Footrot, Lumpywool)

### **Symptoms**

Scabs form over the body that mat the hairs together. Extensive face and mouth lesions are common in some tropical areas. Acute generalized infection can occur in as short a time as 2 weeks or may take years. Additional symptoms are decreased milk production, weight loss, and in severe cases, death. When scabs are removed, the typical form is a cone-shaped scab with a concave bottom and with a yellow exudate under it. The tissue under the scab is red, granular looking and may bleed. During the healing stage the scab will

separate from the skin but mat in the hair. Diagnosis is made from symptoms and laboratory procedures.

### **Cause/Transmission**

The organism is transmitted by insects and tick bites or from contaminated surroundings. Heavy rain or injury to the skin can enable the organism to penetrate the skin.

### **Treatment and Prevention**

A large dose of penicillin (70,000 IU/kg) and streptomycin (70 mg/kg) will halt invasion of the organism as will long-acting tetracyclines. Treatment with chloramphenicol or shorter acting tetracyclines may help if the organism is resistant to penicillin or streptomycin (see Therapy and Techniques). Advanced cases do not respond well and reinfection is common. Prevention is difficult.

### **Human Health Concerns**

None

## **Tetanus** (Lockjaw)

### **Symptoms**

Symptoms of tetanus usually appear 7 to 14 days after the organism enters the body by way of a wound and include general stiffness or hardness of localized muscle groups, such as those in the head and neck. The stiffness and soreness progress to other parts of the body, and after 24 to 48 hours, the complete body is stiff or hard. If the animal can stand, the legs are straddled out, the neck and head are extended, and the tail is erect. The animal will go into violent stiff spasms of the muscles as a reaction to any quick movement, blow to the body, or sudden loud noise. The nostrils will flare, eyes open wide, and the third eyelid or membrane from the middle of the eye will drop about halfway across the eye. Body temperature will rise drastically when the muscle spasms start.

### **Cause/Transmission**

Tetanus is caused by poisons produced by the bacterium *Clostridium tetani*. This organism is very common in soil and in the manure of all animals and man. The disease is spread when bacteria enter living tissue, which may occur in a puncture wound or any type wound that may close up and seal off. The bacteria grow and produce the toxin (poison) which causes the symptoms.

### **Treatment and Prevention**

Treatment is usually unsuccessful; over 80% of the infected goats will die. Large doses of penicillin injected into the muscles, plus sedatives or tranquilizers and 100,000 to 200,000 IU of tetanus antitoxin are required for treatment. Treatment usually is not practical for goats.

Fortunately, a permanent form of prevention is rather simple. Two doses of tetanus toxoid can be given 30 days apart, with a yearly booster shot. This will adequately protect adults for at least 1 year. If a severe wound occurs, give a booster at that time. Tetanus antitoxin (1500 IU) can be given to protect animals when a wound occurs but this only protects for about 30 days. Very young kids, up to 3 weeks of age, can be protected with as little as 150 to 300 IU of antitoxin each. This procedure should be followed when disbudding or castration is done.

### **Human Health Concerns**

The disease is not transmitted from animals to man, but humans can be infected. If the premises are contaminated, immunization of humans is usually recommended. Consult a physician.

## **VIRAL DISEASES: CAUSES, TREATMENTS, AND PREVENTION**

A viral disease is any disease caused by a virus. The incubation period is quite variable. Some viral conditions kill animals outright while others may serve as an insult to tissue thus allowing secondary bacterial growth. Antibiotics do not control viral diseases. At this time there are no commercially available antiviral products for use in animals.

### **Caprine Arthritis Encephalitis Syndrome (CAE - Leucoencephalomyelitis Virus of Goats)**

#### **Symptoms**

Young kids (2 to 4 months old) develop a weakness in the rear legs, stumble, and finally cannot rise. They have no fever, eat well, and appear bright throughout the course of the disease. However, the unused legs lose muscle strength and structure and the infected kids eventually die.

In older goats, the same disease is seen as swollen joints. At least two joints usually are involved. The disease develops slowly, and after 2 or more years, the animal has difficulty using its legs properly. Infected goats have no fever, remain alert, and eat well. However, they do not recover from the arthritis. After several years, they lose weight because they cannot keep up with the herd while grazing. The joints become contracted and many goats walk on their knees.

Diagnosis is made on history of problems with kids and adults in the herd, plus laboratory confirmation from tissues and blood tests.

#### **Cause/Transmission**

Caused by a virus, the disease is spread from older infected goats to kids, perhaps by contact or through the milk from an infected doe to her kid. Only a small percentage of goats ever show signs of the disease, even though a high percentage of tests for the virus will be positive.

### **Treatment and Prevention**

There are no corrective procedures or treatments. Isolating kids at birth and raising them in an area away from other goats has been successful, but this procedure may not be practical except in extreme circumstances.

### **Human Health Concerns**

None

### **Contagious Ecthyma** (Sore Mouth, Orf)

#### **Symptoms**

Symptoms are thick, scabby sores that occur on the lips and gums and may be seen on udders or other areas that have little hair. When the lesions appear on udders, they are painful and the doe will not allow the kids to nurse. Mastitis often will develop. Kids may show lesions on rear legs.

#### **Cause/Transmission**

Contagious ecthyma is a viral disease of sheep and goats. The virus is very hardy and can live for extended periods away from the host. Kids pick up the disease from surroundings and may spread it to their mother's udder by nursing. Recovery from the disease gives an immunity for at least 1 year. There is little transfer of immunity from the doe to the kid by the colostrum. Very young, severely affected kids may die.

#### **Treatment and Prevention**

Treatment is of little value. Softening ointments may help. Always make sure affected goats are eating and drinking. Soft, tasty feeds are helpful. A vaccine is available and is very effective. Kids should be vaccinated in a hair-free area within 1 month of birth.

Adults need not be vaccinated again after the disease is in the herd and all young have been vaccinated. Continual exposure to the disease will keep the adults immune or resistant to sore mouth.



## **Human Health Concerns**

This disease is contagious to man. People who work with sheep and goats that have sore mouth, or use the vaccine to protect sheep and goats, should wear gloves when handling these animals or the vaccine.

## **Foot and Mouth Disease (FMD)**

(Aftosa, Aphthous Fever, Epizootic Aphthae)

### **Symptoms**

Symptoms of foot and mouth disease in goats are usually less severe than those seen in cattle. Goat symptoms include dullness, fever, and small blisters on the mouth and tongue that break and leave small pits. Small blisters also will appear between the toes and on the feet. These areas turn pale and then peel off, leaving erosions and sores between the toes. The affected animals are very lame. The same type of blisters and erosions appear on the teats. Affected animals will not eat, and if the feet are very sore, will not stand. Sometimes the first symptoms are sudden death in kids, with abortions in the adults. **Ministries and Departments of Agriculture require that FMD be reported, if suspected.** Diagnosis is based on symptoms and laboratory confirmations. The disease should be differentiated from goat pox, PPR, and contagious ecthyma.

### **Cause/Transmission**

Foot and mouth disease is caused by a virus that has seven types and over 60 subtypes. It is widespread over much of the world. The disease is spread by swallowing the virus on feed or by inhaling or getting virus particles in the eyes from virus-laden air. Spread by recovered carrier cattle, sheep, goats, and hogs, foot and mouth disease can occur for a year or longer after the symptoms are gone. There is some evidence the virus can be spread through the air by winds.

### **Treatment and Prevention**

There is no effective treatment. Vaccination can be made as a preventative measure against the

type that occurs locally. Some countries use the eradication method--all exposed and sick animals are destroyed, then burned, or buried.

#### **Human Health Concerns**

None

### **Nairobi Sheep Disease**

#### **Symptoms**

This disease is marked by high fever, runny nose, and bright green, watery diarrhea that may contain blood and mucous flecks when the animal is near death. The animals have a poor appetite, weaken, and cannot rise. Pregnant does frequently abort. Goats usually recover.

#### **Cause/Transmission**

Nairobi sheep disease is an infectious, non-contagious viral disease transmitted by the brown tick *Rhipicephalus appendiculatus*. This disease has been reported only in eastern and central Africa. It is transmitted from goat to goat by the bite of the brown tick.

#### **Treatment and Prevention**

Treatment is of little value and most goats eventually recover. Goats should be dipped or sprayed at weekly intervals to control ticks. A vaccine is being developed.

#### **Human Health Concerns**

None

### **Papillomatosis (Warts)**

#### **Symptoms**

Typical wart-like growths appear on the skin. Similar wart-like growths on the udder and teats are not caused by this virus; the cause is unknown.

#### **Cause/Transmission**

Goat warts are caused by a virus that affects only goats. The disease is found worldwide. In

infected herds, the virus is widespread in the environment and may enter into any scratch or break in the skin. It takes about 1 month for the warts to grow. Most warts usually fall off within a year, due to an immunity built up by the infected goat.

#### **Treatment and Prevention**

Warts can be cut off, burned off, or frozen. There is no practical prevention.

#### **Human Health Concerns**

None

#### **Peste Des Petits Ruminants**

(Pseudorinderpest of Small Ruminants,  
Peste of Sheep and Goats, Kata, PPR,  
Stomatitis-Pneumoenteritis Syndrome)

#### **Symptoms**

A sudden rise in temperature, up to 41C (106F), is seen in goats that appear dull and restless. They have a dull coat, a dry muzzle with a clear discharge, very little appetite, and red-denning around the eyes. There may be some red or raw areas in the mouth. Diarrhea, dehydration, emaciation, and collapse sometimes occur. Pneumonia may develop as a complication. Most infected goats die within 8 to 10 days.

Several other diseases have similar symptoms, thus laboratory diagnosis should be made using blood and culture tests. It has been reported to be 10 to 90% fatal in goats.

#### **Cause/Transmission**

The disease is caused by a virus and has been reported only in West Africa. It is transmitted by direct contact with sick animals or with areas where sick animals have been recently kept. All tissues and fluids from sick animals contain the virus and are considered infectious. Cattle exposed to the virus do not become sick but do become immune to rinderpest. (Note: Rinderpest disease of cattle has been reported to cause a similar set

of symptoms in sheep and goats; however, the symptoms are much less severe.)

### **Treatment and Prevention**

There is no effective treatment. A vaccine that will protect sheep and goats for about 1 year is available in some areas.

### **Human Health Concerns**

None

### **Rabies**

(Hydrophobia, Lyssa, Mad Dog, Le Rage, Tollwut)

### **Symptoms**

You should be **extra cautious** in diagnosing rabies. Symptoms include confusion, depression, loss of milk production, and loss of appetite. Many infected animals may chew on foreign objects such as wood or rocks. They may not be able to swallow, and saliva or water will drool from their mouth. **Hydrophobia or "fear of water" is not a symptom of rabies in animals.** Infected goats may or may not bleat, but, if they do, it will be unusually low and off-key. Also, the eyes will "stare" from dilated pupils.

### **Cause/Transmission**

A virus-caused disease of all warm-blooded animals and man, rabies is distributed over most of the world, except for those countries where it has been eradicated. The virus is in the saliva of the rabid animal and is most commonly transmitted by its bite. Rabies also can be contracted when saliva from an infected animal enters an open wound (for example, when licked). The virus has been transmitted to humans from bats in caves, probably by breathing small virus-laden droplets. The bite of the vampire bat is a common method of transmission. The incubation period for rabies can be very long, up to 10 months or so. It is usually about 2 weeks.

Rabies is always fatal. It is not commonly seen in domesticated animals raised for food, and in most cases they do not readily transmit it since

they do not normally bite for self-protection. However, it is very common for people to think the goat is choking and stick their hands into its mouth. Choking is **very unlikely** in a goat. Diagnosis on symptoms alone is impossible due to the many similar diseases of the central nervous system. Laboratory diagnosis is necessary.

### **Treatment and Prevention**

There is no effective treatment after symptoms develop. Preventive treatment for humans is practiced immediately after exposure. This is not practical in animals, which are usually destroyed.

There are several vaccines available for animals. These are especially useful in South America where vampire bats are common and are primary spreaders of rabies. **Never** use a vaccine on an animal for which it is not specifically intended. **Read the label.** Low egg passage vaccines, for example, are fine for dogs but **will cause rabies** in cats, cattle, horses, sheep, and goats.

### **Human Health Concerns**

You can contract rabies from animals and it is **100% fatal**, once symptoms develop. When an animal shows severe nervous signs or unusual changes in behavior, either aggressive or passive, always consider rabies a possibility until it can be ruled out. Do not make any assumptions or take any chances with this disease. Remember, it is 100% fatal to humans. If exposure to humans has occurred, **always** consult a physician.

## **Rift Valley Fever**

### **Symptoms**

High abortion rate occurs in adults and high death losses among very young animals. Sick animals show a rapid rise in temperature and a rapid, weak pulse. Gait is unsteady. Sores sometimes appear on the tongue and cheeks. Milk production rapidly decreases. Death losses are extremely high for young lambs, kids, calves, and puppies. Adult sheep, cattle, and goats suffer a 10 to 20% death loss.

### **Cause/Transmission**

Sheep, goats, cattle, very young puppies, and humans are affected by this virus-caused disease, transmitted primarily by mosquitoes. Ticks have also been identified as carriers. The disease is seen primarily on the African continent, usually during the wet season.

### **Treatment and Prevention**

There is no effective treatment. Prevention consists of housing animals in insect-proof buildings or moving them to highlands away from insects. A vaccine is available; however, it is a live-virus vaccine and will cause abortions in pregnant animals and deformities in the fetus.

### **Human Health Concerns**

Humans are infected both by insects and by handling animals and tissues affected with this virus. Meat from infected animals should not be eaten. In humans, the disease is not usually fatal but does cause a long, 7 to 10 day flu-like disease that is very debilitating and painful. A vaccine is available for use in humans.

## **Scrapie**

### **Symptoms**

Early symptoms of scrapie are nervousness, slight muscle tremors, dull hair coat, and a slightly wobbly gait (especially if the animal is excited). As the disease slowly progresses, itching begins, usually at the top of the tail and progresses forward over the body. The animal will rub, scratch, bite, or do anything to scratch this area. A high degree of pleasure is derived from this scratching and the animal will lift its head and nibble with its lips and lick its tongue, as if enjoying the scratching. All the hair over these itching areas is often rubbed from the body. The animal will progressively lose weight, yet will eat until a day or so before dying. About 1 week before death it will lie down and be unable to rise. You can usually expect no more than 1 to 2 animals in a herd to be infected at any one time,

but up to 50% will eventually become infected. Diagnosis can be made from symptoms, but confirmation in a laboratory is necessary.

### **Cause/Transmission**

Scrapie, a disease primarily of sheep and occasionally of goats, is caused by a slow virus or viroid (very small virus-like particle). The incubation period, according to most research, is from 18 months to over 4 years. As a result, it is usually seen in animals from 2 to 6 years old. Death losses are 100% once signs develop. From initial signs to death, 2 to 6 months will pass. The disease is thought to be spread by contact with infected animals and from mother to offspring.

### **Treatment and Prevention**

There is no effective treatment. Several countries have eradication programs for scrapie. If this disease is suspected, the **Agriculture Department authorities should be contacted**. To prevent scrapie, buy from healthy herds and avoid all contacts with infected sheep and goats.

### **Human Health Concerns**

There is no known connection at this time to two similar human diseases. However, most countries recommend that meat and products from infected animals not be used for human consumption, because of this similarity. Scrapie can be transmitted to some monkeys.

## **Sheep/Goat Pox**

### **Symptoms**

Sheep/goat pox infects all ages but is more severe in young animals. Early symptoms are a runny nose, red eyes, fever, poor hair coat, standing with an arched back, and lack of appetite. One or 2 days later, numerous nodules (lumps) develop all over the body but are most visible in areas with little or no hair. Most of these lumps develop a scab that remains for 3 to 4 weeks. Removal of these scabs leaves a pit or pock mark. The same type of eruption will develop inside the

mouth and throughout the body. Sheep and goat pox should be differentiated from contagious ecthyma.

**In all countries, when this disease is suspected, it should be reported to the Agriculture Department authorities.** The death rate can reach 80%, usually caused by pneumonia.

#### **Cause/Transmission**

Common in the Middle East, the Indian subcontinent, and Africa, this virus-caused disease is spread by small droplets in the air and by contact with sick animals.

#### **Treatment and Prevention**

There is no effective treatment. Antibiotics may help prevent pneumonia. A vaccine is available for use in problem areas.

#### **Human Health Concerns**

None



## **METABOLIC DISEASES: CAUSES, TREATMENTS, AND PREVENTION**

Metabolic diseases are those that involve the lack of or unusual breakdown of physical and chemical processes in the body.

### **Acidosis/Indigestion/Impaction/Choke**

Each of these conditions is related to feeding.

**Acidosis** occurs when goats overeat easily digested feed with high levels of starch or sugar, including grains, grain by-products (brewer's waste or germ), and vegetable parts. The pH of the rumen will change to an acid state, usually below 5. The animal may bloat, refuse to eat, develop a severe diarrhea, and become dehydrated (eyes sink into head and skin loses elasticity). Pain is exhibited by grinding of the teeth. Rumen motility will stop and the rumen will feel watery. The animal will weaken, stagger, and be unable to stand. If not treated, the goat usually dies in 1 to 2 days. Treatment consists of using a stomach tube to administer oil and a mixture of charcoal and sodium bicarbonate (see Techniques and Therapy). Surgical clean-out of the rumen is required in many cases, only with aid of a veterinarian.

**Indigestion** is usually a mild form of acidosis. Symptoms include lack of rumen motility, loss of appetite, and decreased milk production. Some charcoal-bicarbonate mixture and a mild laxative, like milk of magnesia (45 to 60 ml) or magnesium sulfate (epsom salts, 15 to 30 g mixed in 100-200 cc of water), will usually correct the problem when given by mouth or with a stomach tube (see Techniques and Therapy).

**Impaction** occurs when poor quality roughage is consumed faster than it is broken down by the digestive process in the rumen and passed on through the digestive tract. Sudden changes in the type of feed will slow passage of the material through the rumen and can also cause impaction or indigestion. Correcting rumen impaction almost always requires a surgical procedure (rumenotomy) and the services of a veterinarian.

**Choke** is not common in goats, unless they are feeding on vegetable or fruit waste. If a stomach tube is gently passed down the throat, the obstruction can usually be pushed into the rumen. If the tube procedure fails, contact a veterinarian for surgery.

#### **Human Health Concerns**

None

### **Allergies/Insect Stings**

#### **Symptoms**

Severe generalized symptoms such as sudden collapse, coma, and death may appear from allergies/insect stings. Less severe and more common symptoms may include respiratory distress (difficulty breathing), heart irregularities, excessive saliva flow from the mouth or tears from the eyes, mild to severe itching, lumps (hives) that appear on the skin suddenly, hair standing erect, swelling of tissues with fluid retention (edema), and red areas on the skin. Common causes of allergies are feeds, injections, applications to the skin, and insect bites.

#### **Cause/Transmission**

An allergy is the reaction to a substance (usually a protein) with which it has had previous contact and to which the body has developed an immune sensitivity. Many substances can cause allergic reactions with varying degrees of severity. Some examples are pollens or other plant proteins, insect stings, many drugs and biological substances such as antisera, vaccines, or antibiotics. Many times the allergic reaction is dose related: small doses cause small reactions and large doses cause severe shock or even death. These reactions can occur almost immediately after contact or up to 3 weeks later.

#### **Treatment and Prevention**

Immediately remove the animal from its surroundings because the allergen usually is nearby. If the suspected allergen was applied to the skin,

wash the animal with soap and water. (Protect yourself from the suspected allergen.)

Do not wash the goat in a river; the allergen could kill fish or contaminate a water supply. If the goat is dying, epinephrine should immediately be given intravenously or subcutaneously (see Therapy and Technique). Doses of antihistamines and corticosteroids injected or taken orally usually produce a dramatic response, completely reversing or greatly reducing the severity of the symptoms. To prevent further recurrence, do not place the animal in the same environment or use the same products.

### **Human Health Concerns**

None

### **Bloat**

(Ruminal Tympany, Tympanities, Hoven, Meteorism)

### **Symptoms**

In addition to pain, discomfort, and difficulty in breathing, the goat has a full left flank, jutting up and out, that sounds like a drum when thumped. Sometimes the right side also will be enlarged, but it will protrude outward. Rumen movement usually continues until the inside of the mouth and the area around the eye turn blue instead of pink. This change indicates a lack of oxygen and approaching death.

### **Cause/Transmission**

Basically, bloat stems from the goat's inability to get rid of gas produced in the first compartment of the stomach--the rumen. This condition is nearly always an emergency. The gas can be free or mixed with the feed in the rumen (frothy bloat). If not relieved, it will cause extreme discomfort and death from reduced ability to exchange oxygen in the blood.

Bloat, especially frothy bloat, can be caused by feeding on legumes (especially alfalfa [lucerne] or clovers) and small grain pastures (wheat, barley, oats, and rye). Almost any feed can cause bloat if the animal cannot belch gas away, as can

blockage of the esophagus (tube from mouth to stomach) by feed, froth, or a foreign object.

### **Treatment and Prevention**

Swift treatment is necessary. Force the goat to stand and walk. Tie a stick or rope in the mouth for the goat to chew on. This stimulates saliva and helps reduce bloat.

If the animal is in critical condition, pass a rubber tube down the throat (see Techniques) into the rumen. Use a tube no larger than 1 to 2 cm or 1/2 to 3/4 in. in diameter. To see if the tube has reached the stomach, place your ear to the stomach area on the left side of the goat and blow into the tube. You should hear a bubbling sound. If the accumulation is a gas bloat, relief is immediate. If it is frothy bloat, relief is limited. Pour or pump 100 to 200 cc (1 to 1 1/2 cups) of mineral or vegetable oil into the stomach by way of the tube. Sometimes 100 mg/kg of Poloxalone orally will help reduce frothy bloat. If no mineral or vegetable oil is available, unused motor oil will serve. **Do not use the motor oil unless necessary. Never use used motor oil.**

As a last resort, a large gauge needle, trocar and cannula, or piece of hollow stick (bamboo) can be punched into the left side of the goat. This treatment is considered only as a last resort because **60 to 80% of the animals so treated die of infection** several days later. Best prevention is careful attention when herd is grazing legumes.

### **Human Health Concerns**

None

### **Colostrum Deprivation (Hypogammaglobinemia)**

#### **Symptoms**

If a kid does not obtain enough colostrum, it will not have adequate disease protection. Such kids will probably be sick most of their lives. If they live through the first month or 6 weeks, they will probably survive because they can then build

their own immunity. Many hypogammaglobinemic kids are stunted, however, and do not mature properly.

### **Cause/Transmission**

Newborn goats have little or no immunity to disease. Antibodies (disease protective particles) do not pass from the doe to the kid before birth. As a result, the doe builds a very high level of antibodies in the udder, primarily gamma globulin. The kid is capable of absorbing these protective bodies through the stomach and intestinal wall for a short time after birth, with peak absorption during its first 6 to 12 hours. This ability decreases rapidly over the next 12 hours; when 24 hours old, the kid can no longer absorb the antibodies. Because the doe's first milk, called colostrum, is high in antibody level, it is very important for the kid to nurse soon after birth. It should receive about 10% of its body weight in colostrum the first day of life. This would amount to nearly 236 ml (1/2 pint) for the average-sized kid.

### **Treatment and Prevention**

There is no effective treatment after the condition occurs. Blood transfusions sometimes help, but these should be done by a veterinarian. Prevention is simple; be sure the kid has adequate colostrum before it is 6 hours old. If the kid is weak and cold, warm it gently by applying warm water or warm towels to its body. Tubing techniques using a small rubber catheter can and should be used to place warm colostrum into the stomach (see Techniques).

### **Human Health Concerns**

None

### **Grass Tetany**

(Grass Staggers, Hypomagnesemia Tetany)

### **Symptoms**

A goat suffering from grass tetany is first nervous and trembling, becomes progressively weaker, and then lies down and cannot stand. Symptoms can resemble milk fever.

### **Cause/Transmission**

Grass tetany occurs when feed is low in magnesium content. The symptoms appear when the level of magnesium in the blood drops below a critical level. This usually occurs when lush green grass is the only feed or when pastures are fertilized with potash during the wet, fast-growing season. Lush green grass may be low in magnesium. Fast passage and other factors may also limit the uptake of magnesium by the animal.

### **Treatment and Prevention**

Treatment consists of IV administration of drugs containing magnesium. Usually milk fever remedies contain enough magnesium to treat this condition (see Therapy and Techniques). It is best prevented by feeding some legume hay and grain and by not allowing high milk producers to feed solely on lush grasses. Some dry straw-like forage might help reduce intake of grass or slow the passage of the grass through the digestive tract.

### **Human Health Concerns**

None

### **Milk Fever**

(Parturient Paresis, Hypocalcemia)

### **Symptoms**

With milk fever, the doe walks with wobbly gait or with foot dragging. She may be constipated or too weak to deliver her kids. Occasionally, the goat will not be able to stand and will be depressed. Keep the doe's head slightly elevated and to one side so that if she vomits, fluid will not enter her lungs.

Laboratory confirmation of diagnosis is shown by a decreased serum calcium level, usually below 6 mg/100 ml.

### **Cause/Transmission**

When about to kid, the affected doe is unable to make a normal release of calcium stored in the bones for the production of milk. Because calcium cannot be obtained from the bones, she will use the

calcium available in her bloodstream. When this calcium level drops to a critical level, symptoms of milk fever appear. This is most commonly seen when excessive levels of calcium are fed late in pregnancy.

### **Treatment and Prevention**

Treatment consists of a slow and cautious IV dose of 25% calcium borogluconate solution; usually 50 to 100 ml. If the product label indicates, half of this dose may be given intravenously (IV) and the other half subcutaneously (SQ) to reduce likelihood of heart block from the intravenous calcium (see Therapy and Techniques). The response will be slower but almost as effective. Extreme caution should be used if intravenous calcium is being given. Feel the heart or listen for an increased or severely decreased rate while the solution is going into the goat.

As a preventative measure, feed the doe a relatively low calcium diet during the final 30 days before birth. For example, feed only grass hay and no alfalfa or other legumes. This diet forces a hormone release to remove calcium that is stored in the bone, and the mechanism will be working well when the doe needs the calcium to make milk. After the kids are born, resume feeding the regular high calcium diet, including alfalfa hay.

### **Human Health Concerns**

None

### **Physical Injury/Wounds/Burns/Fractures**

Goats are often injured in fights with dogs, predators, and other goats. Usually, with a little help, the animal will heal itself. First, bleeding should be stopped. This can normally be done by applying mild pressure. Second, clean the wound with mild soap and water. Remove all dirt, hair, and trash. Be gentle so as not to cause renewed bleeding. Next, apply an antibiotic ointment, cream, or powder to the area. Finally, apply a bandage if the damaged area is large. Most wounds do not require bandaging.

Also clean and protect burned areas with an ointment. Use a saline or salt solution for cleaning and do not damage the burned area. If no antibiotic ointment is available, butter or cream will help.

If the wounds or burns are severe and large areas of skin are destroyed, the goat probably should be slaughtered.

Fractures and dislocations sometimes are seen when goats fight or get entangled in fences, feeders, or other equipment. Dislocations of joints are seen as an abnormal angle of the long bones from a joint. These are usually fixed or difficult to move. Sometimes the part farthest from the body can be pulled and it will pop back into place. If this cannot be done, the animal should probably be slaughtered. Fractures are usually of the long bones. Abnormal angle, loose movement, gritting of the fractured ends or protrusion of the bone ends into soft tissue or penetrating the skin will enable you to diagnose this condition. If the bone ends are in apposition (together), there is no penetration of the skin, and if the animal is valuable enough, the fracture may be cast and may heal in 6 to 8 weeks. Usually, however, it is best to slaughter as soon as possible after the break occurs.

In any of the above conditions, always assess the chance of survival and ability to return to useful service as compared to the immediate value for meat. If the value as meat equals or exceeds the chance for return to service, the best alternative is slaughter.

#### **Human Health Concerns**

None

### **Polioencephalomalacia**

#### **Symptoms**

The goat shows sudden loss of appetite, depression, no fever, and normal or slightly reduced rumen motility with polioencephalomalacia. Nervous system signs are head pressing, grinding of teeth, aimless wandering, blindness, abnormal eye move-



ments, muscle tremors, and overreaction or jumping when touched. When the goat is unable to stand, the head usually will pull back. Convulsions and death follow in a few hours.

### **Cause/Transmission**

Polioencephalomalacia is a noninfectious disease of fast-growing kids and young adult goats. The actual cause of the disease is unknown, but may be due to molds on the feed that break down vitamin B<sub>1</sub> thiamine in the animal. It is usually seen in animals on a high grain ration and sometimes after a change in management practices.

### **Treatment and Prevention**

Treatment requires thiamine injections of a total of 5 to 10 mg/kg, one-half of the dosage given IV and one-half given IM (see Therapy and Techniques). Additional half doses should be given IM every 12 hours until the animal has recovered. If the goat shows little improvement after 2 or 3 days, slaughter should be considered. No preventative measures have been reported.

### **Human Health Concerns**

None

### **Pregnancy Toxemia (Ketosis)**

#### **Symptoms**

Does with pregnancy toxemia are depressed, weak, and have poor muscle control and balance late in pregnancy. Later they lie down and are unable to rise. Death follows within a few days. After lying down, their symptoms often resemble those of milk fever. If treated for milk fever, they will respond for a few hours in most cases and then relapse. This is because the products sold for milk fever contain 20% or more simple sugars, which will give temporary improvement. Early in the disease, many does will show a positive test for ketone bodies in the urine. Such test kits are often available and easy to use.

### **Cause/Transmission**

Pregnancy toxemia occurs only within the last few weeks or days of pregnancy. It is usually seen when the doe is carrying two or more kids, or when the doe is very fat. This disease is caused by the sudden extra demand for energy by the fast-growing kids in the pregnant goat. Because the uterus containing the kids, fluids, and membranes requires increasing amounts of space inside the doe, she has a decreasing amount of space available in the rumen to hold roughage. Also, if the doe is fat, she has less room to hold feed than if she were in better condition. In either case, the end result is less available space for feed intake. To keep the kids alive, the doe will metabolize or break down fat from her body stores or break down her own body resources to maintain the pregnancy. This rapid breakdown of body stores produces ketones (a toxic by-product) and the symptoms of the disease. Do not allow fat does to lose weight in late pregnancy. Try to keep them from becoming overly fat earlier in the pregnancy.

### **Treatment and Prevention**

If the doe lies down and cannot stand, treatment is usually not successful unless she delivers at that time. Treatment with propylene glycol at 60 to 90 ml (2 to 3 oz) twice a day will help, as will treatment with corticosteroids and adding grain to the ration (see Therapy and Techniques). Cesarean section to deliver the kids early will sometimes save the doe and the kids if they are near term.

As a preventive measure, do not let the doe get fat early in pregnancy. **Do not** add a great quantity of molasses to the feed. Grain (primarily corn or sorghum) or grain by-products are a much better source of energy and cause less indigestion. Oats are high in fiber and are not as good as corn or sorghum (milo). The last 4 to 6 weeks of pregnancy the doe will require .47 to .90 kg (1 to 2 lb) of good quality grain or grain by-products and grass or good quality hay. If she is very large, or has a history of having three to five kids, this diet will not be sufficient and should

be increased 50 to 100%. Protein requirements should also be balanced, but protein level is not related to pregnancy toxemia.

**Human Health Concerns**

None

**PARASITIC DISEASE: CAUSES, TREATMENTS, AND  
PREVENTION**  
(Blood Parasites)

A parasitic disease is any disease condition caused initially or totally by the presence and activities of either internal or external parasites. This can occur in or on most parts of the body.

**Anaplasmosis**

**Symptoms**

Anemia is the most common symptom. Anemic animals have poor appearance and do not milk or reproduce well.

**Cause/Transmission**

This blood parasitic disease of sheep and goats is caused by the rickettsia *Anaplasma ovis*. The disease is usually passed from animal to animal by infected ticks, bloodsucking flies, and blood-contaminated needles and surgical instruments. Infected animals that show no symptoms of the disease are carriers of the organism. The disease is fairly common in areas where anaplasmosis occurs in cattle.

Diagnosis requires a laboratory examination for the organism inside the red blood cells.

**Treatment and Prevention**

Tetracycline drugs are recommended for prevention and treatment. Suggested treatment is based on cattle-dosage control at 4 mg/kg IM every 30 days with the 200 mg/cc oxytetracycline, or administered orally in feed at 20 to 30 mg per head per day on a continuing basis. Control of flies and ticks will help, as will sanitation of instruments used for castration, etc. (see Therapy and Techniques). Severe stress also tends to increase the risk of an anaplasmosis outbreak.

**Human Health Concerns**

None

## **Babesiosis** (Red Water)

### **Symptoms**

Sheep and goats usually show no outward clinical signs of *Babesia* infection. There may be a slight anemia and slight decreases in milk production, fertility, or growth rate. When such symptoms occur, you should look for fever, anemia, depression, and sometimes dark red urine. Most infected goats recover completely in a short while.

Diagnosis requires a diagnostic laboratory examination for the *Babesia* organism inside red blood cells.

### **Cause/Transmission**

Two blood parasites, *Babesia motasi* and *Babesia ovis*, are thought to cause babesiosis in both goats and sheep. Transmission is most likely by ticks belonging to the genus *Rhipicephalus*. This disease is most commonly seen in tropical areas.

### **Treatment and Prevention**

Administer acaprin or diminazine aceturate (Berenil). Control and prevention are based on controlling ticks with dips or sprays (see Techniques).

### **Human Health Concerns**

None

## **Heartwater**

### **Symptoms**

Symptoms of heartwater vary from a sudden onset of high fever, convulsions, and death in 24 to 48 hours to an acute stage showing fever, reduced feed intake, depression, and rapid breathing. After 24 to 48 hours, the goat will show nervous signs such as twitching of the eyelids, protruding tongue, walking in circles, or high stepping. The goat may stand with its legs widespread and the head lowered as if to brace itself. As nervous symptoms increase, the animal will lie down and

start galloping movements. Death follows within 1 week of the first symptoms. A subacute form sometimes occurs with mild fever, slight incoordination, and recovery or death in about 2 weeks. Another form is seen primarily in wild ruminants and consists only of a high fever for a short time.

When diagnosing in the field, look for the presence of the "bont" tick (*Amblyomma hebraeum*). Postmortem signs of fluid around the heart and lungs also are helpful in diagnosis.

### **Cause/Transmission**

Heartwater is seen in Africa and possibly in some Caribbean countries. It is caused by the rickettsia *Cowdria ruminantium*. The disease is not contagious from animal to animal; it must pass through the three-host tick *Amblyomma hebraeum*. Once infected, the tick remains infected for life but does not pass the infection to its offspring.

Laboratory tests are necessary to confirm the diagnosis. Heartwater has symptoms similar to other diseases of the nervous system, including tetanus (lockjaw), rabies, trypanosomiasis, piroplasmiasis, or poisoning by some plants, insecticides, and lead. Diagnosis is difficult.

### **Treatment and Prevention**

Tetracyclines administered early provide good recovery and do not affect the immunity produced by having the disease. Prevention is difficult. In most places, young animals are infected artificially and then treated to provide immunity. Goats in areas where the disease is prevalent remain immunized by continued exposure (see Techniques).

### **Human Health Concerns**

None

### **Trypanosomiasis** (Nagana, Sannare)

### **Symptoms**

Symptoms of trypanosomiasis are primarily anemia, chronic weakness, and weight loss. Some 10 to 15% of untreated animals eventually die.

### **Cause/Transmission**

Trypanosomiasis is caused by a blood parasite of sheep and goats transmitted by the bite of a tsetse fly and caused by *Trypanosoma brucei*, *T. congolense*, and *T. vivax*. Sheep and goats are not severely affected by these diseases, probably because the tsetse fly seldom feeds on them. Several African breeds appear to be trypanosome tolerant. This disease is seen only where the tsetse fly is found in Africa.

### **Treatment and Prevention**

Treatment and prevention consist of injections of diminazene aceturate (Berenil) and homidium compounds (Novidium and Ethidium) and controlling the tsetse fly. When crossbreeding trypanosome-tolerant native goats with exotic breeds to improve production, the kids will usually be more susceptible to trypanosomes than their native parent; but they will be more tolerant than their exotic parent.

### **Human Health Concerns**

Although it can occur in man, trypanosomiasis is not contagious nor passed from infected goats or sheep.

**PARASITIC DISEASES: CAUSES, TREATMENTS, AND  
PREVENTION**  
(Internal Parasites)

**Coccidiosis**

**Symptoms**

The symptoms of coccidiosis can vary from some loss of appetite and slight, short-lived diarrhea to severe cases involving great amounts of dark and bloody diarrhea, straining, loss of weight and appetite, and dull appearance, with up to 15% dying. The feces of sick goats contain many infective stages of the coccidia. When an outbreak begins, only good sanitation and isolation of sick animals will prevent its spread through the herd. Goats that survive through a disease outbreak are usually immune to future problems.

Diagnosis is based on history, symptoms, and microscopic examination. Presence of coccidia in the feces of normal goats does not indicate a disease situation. Do not treat unless symptoms are present.

**Cause/Transmission**

Coccidiosis is caused by a tiny parasite, *Eimeria spp.*, that lives in the cells of the goat's intestines. The tiny oocysts containing the infective stages are passed in the feces and contracted by other goats through contaminated feed and water. The number of parasites that invade the intestine determines the severity of the symptoms. If the goat is under severe stress, the disease becomes more severe, and other diseases such as pneumonia may be triggered. The combination of coccidiosis with another disease is usually fatal. The disease is most often seen when goats are crowded into very unclean quarters. Coccidia are species specific and do not pass directly to or from other animals.

**Treatment and Prevention**

Several products are used in treatment, including two feed additives and a water additive. However, the best treatment for the individual goat is a first dose of sulfa drug at 200 mg/kg body



weight followed by a half-dose (100 mg/kg) for 4 days (see Therapy and Techniques). Without good sanitation, however, treatments are ineffective. Keep kids out of feed troughs, and arrange water troughs so that manure will not enter the water. Reduce crowding and stress, and separate the kids from the adult goats. Goats that have been exposed to low levels of coccidia or have been treated and recovered develop a strong immunity.

### **Human Health Concerns**

None

## **Flukes or Flatworms**

### **Symptoms**

Goats with flukes or flatworms may show poor production and growth, bottle jaw, swollen and painful abdomen, anemia, and sometimes sudden death. Diagnosis is based on symptoms, identification of eggs under the microscope, and postmortem examination of dead animals.

### **Cause/Transmission**

Flatworms are fairly large and live in several areas of the body. The most common is the liver fluke. Figure 1 describes the life cycle of these parasites. See Therapy section and table 1 for control.

### **Human Health Concerns**

None

## **Stomach and Intestine Roundworms**

### **Symptoms**

Anemia (paleness around the eyes, inside the mouth, or inside the edge of the rectum or vagina) is a prime symptom of stomach and intestine roundworms, along with blood loss and gut damage. You may also detect swelling under the jaw (bottle jaw) or low on the abdomen. Diarrhea may occur but sometimes the goat dies before diarrhea can develop. Other symptoms include loss of weight, poor growth, and a marked decrease in milk produc-

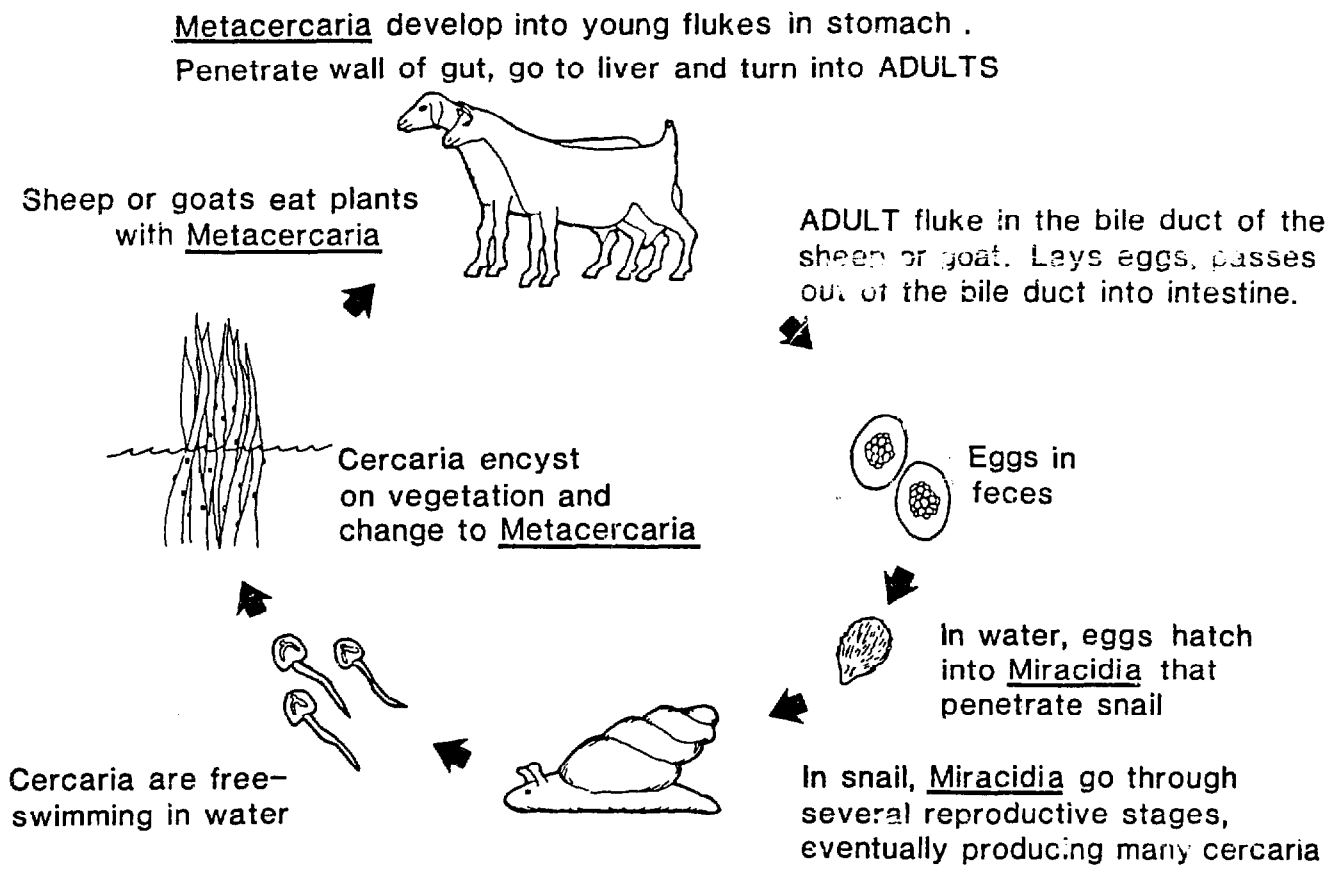


Figure 1. Typical Life Cycle of the Liver Fluke

tion. Normally the parasites require about 3 weeks to complete their life cycle. However, if large numbers of larvae are inactive and lying in the lining of the stomach and intestines, severe parasitism can occur within 7 to 10 days after deworming. Diagnosis is made on symptoms and identification of worm eggs under a microscope. Postmortem examinations of dead goats also will help establish a diagnosis. Most of the adult worms are very small and difficult to observe in the stomach with an untrained eye.

#### **Cause/Transmission**

Young goats are severely affected by these bloodsucking parasites. Figure 2 shows the life cycle of this type worm. All of the many species of these worms cause disease in a similar way.

#### **Treatment and Prevention**

Goats should be treated regularly with drugs. Always treat before the goats are placed onto new pasture, after kidding, and before and after spring growth or rainy seasons. See the section on Therapy for a description of useful drugs. The best preventives are a routine worming program and minimal fecal contamination of feed and water sources.

#### **Human Health Concerns**

None

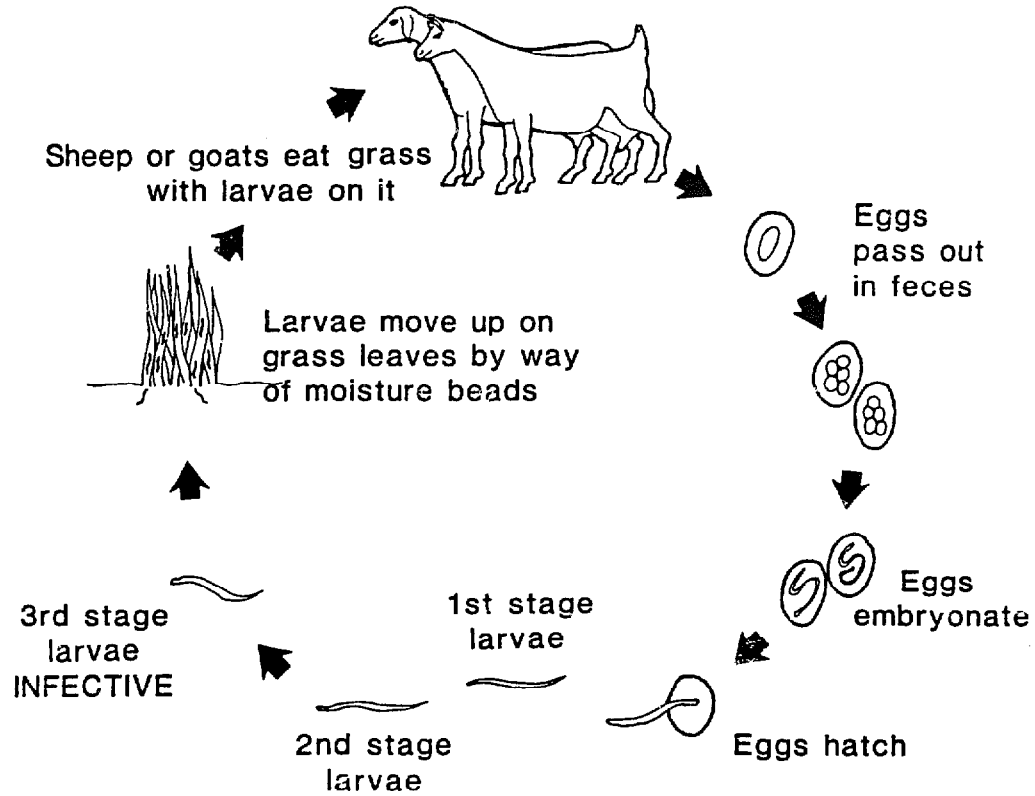
### **Tapeworms**

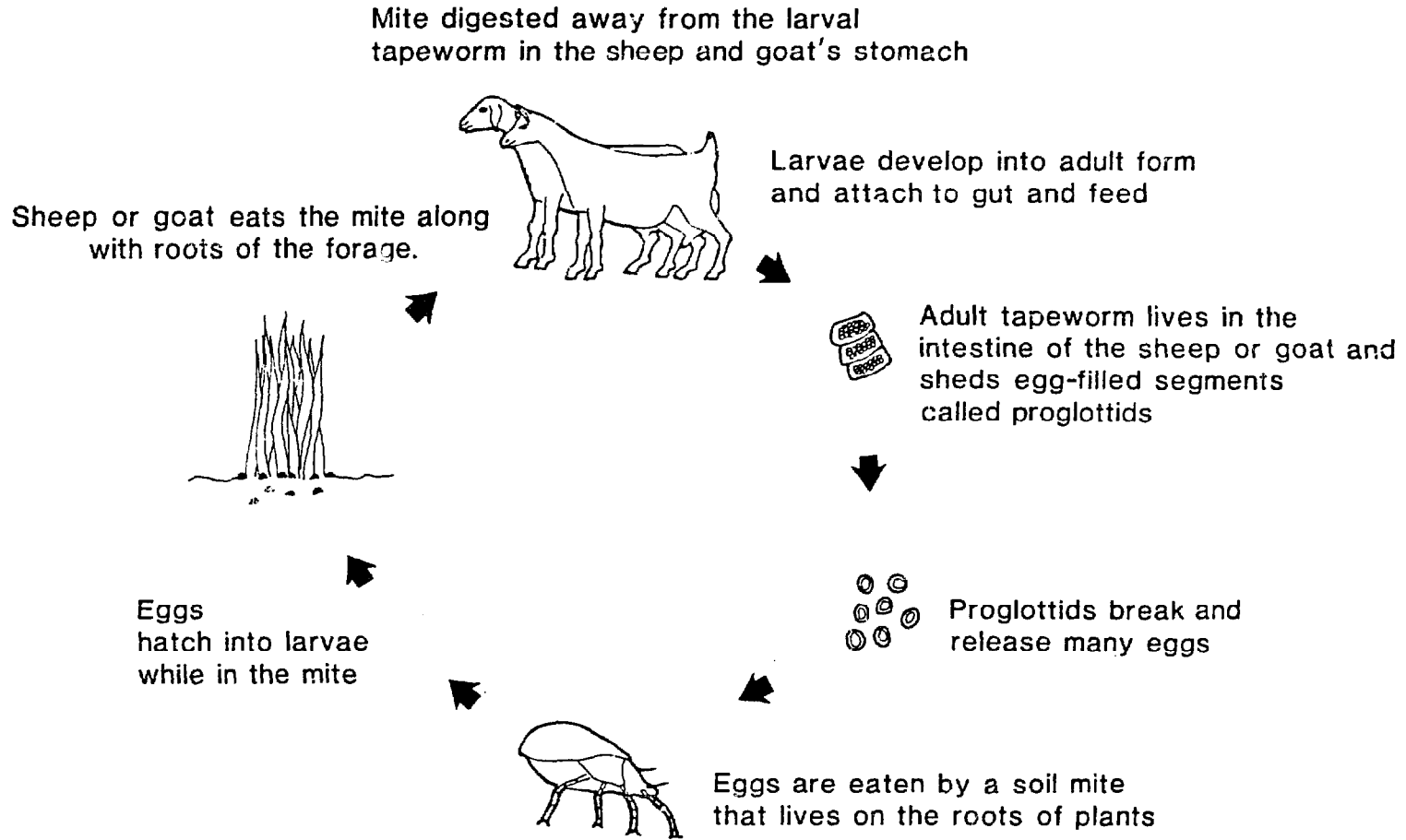
These long, flat, white worms live in the intestine as adult parasites and pass very visible segments out with the feces. They seldom cause any problem, except when great numbers infect very young kids. They are easily controlled (see Therapy). Adult goats usually build an immunity and no longer harbor many of the parasites. The life cycle is shown in figure 3.

#### **Human Health Concerns**

None

3rd stage larvae in sheep or goats develop into 4th stage larvae.  
Some develop into adults and lay eggs.  
Others enter tissue as inactive larvae.





**Figure 3. Typical Life Cycle of the Tapeworm**

## **Toxoplasmosis**

### **Symptoms**

Very rarely does toxoplasmosis cause any sickness in goats and sheep, except an occasional abortion. A few cases have been reported of children becoming infected after drinking unpasteurized or unboiled milk from goats that carry an internal infection. Diagnosis is by laboratory methods only.

### **Cause/Transmission**

The coccidia-like organism first infects cats and can be passed to goats if their feed becomes contaminated by cat feces. Other animals and humans may contract the disease through raw infected meat or by contact with infected urine, feces, or other excretions and fluids of the body, including milk. The disease probably occurs worldwide.

### **Treatment and Prevention**

Some sulfa drugs are used in humans, but animals are seldom treated. Best prevention is by safe-guarding feed supplies from cat feces and by pasteurizing or boiling milk.

### **Human Health Concerns**

The risk is not great for humans but can be passed in unprocessed milk.

## **PARASITIC DISEASES: CAUSES, TREATMENTS, AND PREVENTION**

(External Parasites)

### **Lice** (Pediculosis)

#### **Symptoms**

With rare exception, lice are external parasites that live only on goats. They are very small; only one species can be seen by the naked eye. The symptoms are paleness and itching, with losses in milk production and growth rate due to irritation and blood loss. Diagnosis is made from the symptoms or from seeing some of the lice.

#### **Treatment and Prevention**

Treatment is easy. Many good insecticides are available to kill lice on goats. A dip is best. Soak the goat well. Treat at least twice, about 2 weeks apart, so that newly hatched young lice also will be killed. Use insecticides on kids with extreme caution, as kids are very sensitive. Do **not** spray the premises; lice that infect goats live **only** on goats. Contact with an infected goat will reintroduce the parasite.

#### **Human Health Concerns**

None

### **Mange** (Scab and Follicle Mites)

#### **Symptoms**

The two most common mites infecting goats are the scab mite (*Sarcoptes*) and the follicle mite (*Demodex*). The scab mite causes severe itching, loss of hair, and scab formation. The follicle mite causes small lumps, usually on the forequarters but possibly over the entire body.

#### **Cause/Transmission**

Mange is transmitted by contact with infected goats.

## **Treatment and Prevention**

Both types of mange are difficult to control, especially the follicle mite. Use insecticides thoroughly and repeat at 2 week intervals for 2 to 3 months. Insecticides should be used with caution on kids because of their extreme sensitivity.

## **Human Health Concerns**

Humans may develop scab and follicle mites. However, they may be different from those found on animals. Transmission from animal to man is considered rare.

## **Ringworm**

### **Symptoms**

When ringworms infect an animal, they tend to extend outward from the infected area in a circular pattern. The symptoms are rough, scaly, circular areas where the hair is missing or broken. The areas most commonly infected are the head, ears, neck, and sometimes the body and udder. The condition occurs only on the skin; there is no sickness or death loss. Diagnosis is made from the symptoms. Laboratory confirmation of the fungus can be done but is extremely slow.

### **Cause/Transmission**

Ringworm infection is a skin fungus. Many such organisms can live for long periods in the soil.

### **Treatment and Prevention**

Treatment for ringworm is best done by scrubbing the scales on the skin with a stiff brush or a piece of dull metal or wood. Apply 2 to 7% iodine on the lesion, 2 to 3 times per week. Be careful when applying iodine around the goat's eyes. Rubbing the spots with a paste of the dewormer thia-bendazole, made with the powder and a small amount of water, will usually get rid of the fungus and will not injure the eyes. A suspension of wettable captan powder also works well. The building should be cleaned well after treatment to prevent reinfestation.



## Human Health Concerns

Wash your hands after treating the animal because many ringworms that affect animals can also infect man.

## Ticks, Flies, and Other Pests

Goats are affected by ticks, flies, and other external parasites, including blow fly larvae and screwworms, in many parts of the world. If screwworms exist in the area, avoid surgical procedures (disbudding and castration) during the primary season for the pest. If kids are born during this time, always treat any area where blood is found (navel or reproductive tract of the doe) with an insecticide or a repellent. Many effective products are readily available worldwide.

It is also very important to control ticks because they transmit other diseases. Several good dip and spray insecticides are on the market worldwide. Follow the directions carefully for livestock usage or the recommendation of local livestock officers. Kids are very sensitive to insecticides, so use with care.

## Treatment and Prevention

A list of insecticides and mixing instructions is not included in this guide because of the extreme variability worldwide of products available and recommended. However, the following comments and cautions should be adequate.

1. Any product recommended for a dairy cow should be all right for a goat. Remember, a goat's weight is approximately one-tenth the weight of a dairy cow. Use the same dilutions, but reduce the total dose according to weight if dose is based on body weight.
2. **Always read and follow the manufacturer's recommendations and dilutions as printed on the container.** If they are not on the container or available, refuse to purchase the product.
3. Keep all insecticides away from children and from containers or utensils that will hold milk.

4. Keep insecticides away from drinking water sources and fish. Do not rinse cans in the river.
5. Do not keep empty insecticide containers--puncture, bury, or burn them.
6. Wash your hands well and any other part of your body that was exposed to the insecticide.

Little can be done to prevent reinfestation of these pests other than to confine the goats; however, that is usually not a recommended procedure.

#### **Human Health Concerns**

These parasites affect man.

## THERAPY

### Drug Usage

All drugs should be treated as potential poisons. Antibiotics can cause severe reactions if not used properly. The following recommendations apply to all drugs, regardless of type.

1. **Always read the label and follow the directions carefully.** Administer drugs only as stated on the label. For example, if the label states "for intramuscular (IM) use only," never give the drug intravenously (IV).
2. Out-of-date drugs should be used only when no others are available.
3. Do not mix drugs or give multiple drugs unless on the advice of a veterinarian.
4. Administer drugs for the time recommended on the label or by the veterinarian; the organism may develop resistance to that drug.
5. Antibiotics and sulfa drugs should always be given for at least 3 days or for 2 days after symptoms disappear.
6. Keep all drugs stored in a cool place, 1.5 to 12.5C (3F to 55F), and out of sunlight.
7. Always use sterile equipment when injecting drugs.

The chemical names are used for drugs in this guide because these are the names most likely to be found on the container in most countries. Trade names vary greatly, depending on the country and the company marketing the drug. Any source of a product used in the prescribed route of administration (injection, oral, etc.) and at the correct dosage for that route of administration will usually give satisfactory results. The recommended drugs are suggestions only and are assumed to be the most likely available and the most generally effective. However, many other products and treatment systems will perform equally well. Your veterinarian can usually give you the best advice possible based on knowledge of the local situation.

Remember, you are dealing with a food animal. It may be more beneficial and economical to salvage the animal through slaughter than to treat it with expensive drugs. Make this decision before any drugs are given so as not to contaminate the meat. Make sure no human health concerns apply.

### How to Figure Dosage of Drugs

Liquid dosage in ml =

$$\frac{\text{Dose in mg/kg} \times \text{animal's wt in kg}^*}{\text{Concentration of drug in mg/ml}}$$

OR

Powder dosage in g =

$$\frac{\text{Dosage in mg/kg} \times \text{animal's weight in kg}^*}{\text{Concentration of drug in mg/g}}$$

$$*\text{kg} = \text{pounds} \div 2.2$$

For example, your sick goat weighs about 40 kg. You want to give it an intramuscular dose of oxytetracycline hydrochloride. Your chart shows the dose as 6 to 10 mg/kg. Look on the bottle. It says the concentration is 50 mg/ml. The dose, 10 mg/kg, would be calculated as:

$$\frac{10 \text{ mg/kg} \times 40 \text{ kg}}{50 \text{ mg/ml}} \quad \text{or} \quad \frac{400 \text{ mg}}{50 \text{ mg/ml}} = 8 \text{ ml}$$

The dose for a 40 kg goat at 10 mg/kg of a solution containing 50 mg/ml is 8 ml, given intramuscularly.

Always check the concentration of the solution because it may come in different strengths. For example, the tetracyclines also come in a 100 and a 200 mg/ml concentration. Use the same formula regardless of concentration or whether a liquid or powder.

## Approximate Weights and Measures

1 teaspoon	= 5 milliliters = 60 grains = 60 drops = 5 grams
1 tablespoon	= 3 teaspoons = 15 milliliters = 1/2 ounce = 15 grams
1 ounce	= 30 milliliters
1 cup	= 16 tablespoons = 1/2 pint = 8 fluid ounces = 250 milliliters
1 pint	= 2 cups = 16 ounces = 500 milliliters
1 pound	= 2 cups = 16 ounces = 454 grams
1 ml	= 1 cubic centimeter (cc) = 15 to 16 drops = 1 gram
1 liter	= 1,000 milliliters
1 kg	= 2.2 pounds = 1000 grams

To make 750 ml of a 5% solution, dissolve 5 g in each 100 ml of volume. For a 750-ml liquor bottle, use 37 1/2 g of the powder. Double the powder to make a 10% solution.

## Treatment for Scours or Diarrhea

Check the following signs to estimate percentage of dehydration in kids based on body weight:

<u>% Fluid Loss</u>	<u>Signs</u>
0 to 5%	None
6%	Mouth dry--skin remains erect when pinched
10%	Body cold--unable to stand
12%	Flat on side---shock--near death
Above 12%	Death

The appropriate amount of replacement fluid per day required for a dehydrated kid is the per-

centage of estimated loss due to dehydration plus 10% of the body weight, which is the amount of fluid needed for daily maintenance. For example, a 4.5-kg (10-lb) kid approaching a 10% dehydration factor would need at least 500 ml of replacement fluid just to replace the amount lost. In addition, the kid normally requires about 10% of its weight in fluids each day; therefore the kid in our example would require a total of 1 liter per day.

### **Fluid Replacement Solutions--for Oral Use**

For mixing with these formulas, it is best to boil the water for at least 10 minutes, although regular water sources can be used when necessary.

#### Formula #1

1 package MCP canning pectin  
10 g low sodium table salt  
10 g baking soda  
1 beef bouillon cube dissolved in 200 milliliters of water

Add water until you have mixed 2.5 liters of solution. Use tube or bottle to administer by mouth at a rate of 10% of goat's body weight plus the additional percentage for fluid loss (as estimated using chart above). Divide the total dosage into 2 to 4 parts to be given as the only source of food for 1 or 2 days. Use 1/2 formula and 1/2 milk on the next day and on the following day give 3/4 milk and 1/4 formula. Then give full milk if the goat has improved.

#### Formula #2

10 g table salt  
5 g baking soda  
120 ml white corn syrup or honey

Add water to make 4.5 liters. Give by mouth, with a tube or bottle, at a rate of 10% of body weight plus percentage estimated for dehydration. Divide into 2 to 4 doses per day as the only source of food for 2 days. On third day mix 1/2 milk and 1/2 formula. On fourth day mix 3/4 milk and 1/4 formula. On fifth day give milk only if recovered.

If you cannot find some of the above ingredients, this next solution will help.

### Formula #3

10 g salt

10 g baking soda

Add to 2.5 liters of water. Then, after removing kid from milk, figure 10% of body weight, plus percentage estimated dehydration, and administer orally as one dose. Then divide the total amount into 2 to 4 doses for the next 2 days and gradually return kid to full milk as outlined in formulas above. If the kid does not improve, change the antibiotic used and start the fluid program again in the same way.

### Formula #4

Where coconuts grow, the water from green coconuts can be used as a sterile fluid for replacement purposes.

### **Saline Solution**

Put 1 g salt in 100 ml of water that has been boiled for 10 minutes. Can be administered intravenously or to clean wounds.

### **Teat Dip Formula**

250 ml of 2% chlorohexadine

45 ml glycerine

Chlorohexadine products for human use may be utilized, if necessary. Add water to make 1 liter. Dip the lower 1.5 to 2.5 cm of each teat in a small cup of this solution after each milking.

### **Grain Overload Mixture (for Rumen Acidosis)**

125 g sodium bicarbonate

210 ml 12% formaldehyde solution

5 g magnesium oxide

10 g activated charcoal

Add water to bring contents up to 500 ml. This mixture will keep for 30 days. Shake well before using. To use, take 10 ml per 45 kg (100 lb) of body weight and mix with 1 liter of water. Give as a drench or, preferably, by stomach tube twice a

day. Also give 2 ml dipyrone per 45 kg body weight IM.

### **Foot Bath Mixtures**

(Solutions to Soak Infected Feet)

Copper sulfate: 1/2 kg (500 g) of copper sulfate (bluestone) dissolved in 25 liters of water.

Zinc sulfate: 1 part zinc sulfate to 9 parts water.

Concentrated zinc sulfate foot bath: 1 kg of 99% zinc sulfate in 5 liters of water.

To make a foot bath, soak old rags or wool in the solution and place them in a walk-through trough 5 to 10 cm deep, 30 to 45 cm wide, and long enough that the goat cannot jump over it.



Table 1. Drugs for Controlling Internal Parasites (Anthelmintics and Coccidiostats) <sup>a</sup>

Drug	Roundworms	Larvae	Whipworms	Tapeworms	Lungworms	Flukes	Coccidia	Precautions (always check label for withdrawal information.)
*Albendazole	5-10 mg/kg			5-10 mg/kg		10-20 mg/kg		Do not use 1st third of pregnancy--75 mg/kg fatal.
*Oxfendazole	5 mg/kg	5 mg/kg	5 mg/kg	5 mg/kg	5 mg/kg			Do not use in pregnant animals--safe to triple dose otherwise.
*Cambendazole	10-15 mg/kg	25 mg/kg		20-25 mg/kg	40 mg/kg			Do not use in 1st third of pregnancy. Do not overdose.
*Fenbendazole	5 mg/kg	5 mg/kg	5-10 mg/kg	5-10 mg/kg	5 mg/kg	10 mg/kg or more		Safe in pregnant animals.
Thiabendazole	44-66 mg/kg							Resistance common. Safe in pregnant animals.
*Oxibendazole	5-10 mg/kg	5-10 mg/kg						Safe in pregnant animals.
Mebendazole	13.5 mg/kg			13.5 mg/kg				Safe in pregnant animals.
Levamisole	8 mg/kg				8 mg/kg			Do not overdose or use on milking goats. Safe in pregnant animals.
*Haloxon	50 mg/kg							May cause posterior paralysis.
Phenothiazine	12.5 g/11 to 27 kg 25 g over 27 kg							Do not use last third of pregnancy--only fairly effective. Do not use on lactating does. Do not overdose or use on debilitated animals.
*Morantel	10 mg/kg							Safe in pregnant animals.

\*Drugs not approved for sheep and goats in the U.S.

<sup>a</sup>Note that all dosages are based on active ingredients. Dosages are per kilogram of bodyweight unless otherwise indicated.

Table 1. Drugs for Controlling Internal Parasites (Anthelmintics and Coccidiostats) continued <sup>a</sup>

Drug	Roundworms	Larvae	Whipworms	Tapeworms	Lungworms	Flukes	Coccidia	Precautions (always check label for withdrawal information.)
*Amprolium							10-14 mg/kg 50 mg/kg	Give for 5 days to 21 days. Long term use may cause thiamine (B <sub>1</sub> ) deficiency. One time drench.
*Pyrantel	25 mg/kg							Safe in pregnant animals.
*Monensin							.75 g/44 kg (15 g/ton)	Fairly toxic. Feed throughout feeding period.
Sulfa drugs (dimidine, guanidine, methazine, quinoxaline)							200 mg/kg	Reduce dosage by 1/2 on subsequent days. Treat for 3-5 days. Make sure drinking water intake is normal.
*Lasalocid							1 g/44 kg (20 g/ton) 4.5 g/44 kg (90 g/ton)	In feed. In salt.
*Decoquinatate							.5 mg/kg	In feed for 28 days.
*Avermectins	200 µg/kg	200 µg/kg						Also effective against external parasites. Dosage in micrograms.
Nitrofurazone							7-10 mg/kg	Prescription drug.

\*Drugs not approved for sheep and goats in the U.S.

<sup>a</sup>Note that all dosages are based on active ingredients. Dosages are per kilogram of body weight unless otherwise indicated.

Table 2. Antibiotics and How to Use Them

Antibiotic	Route to be given:	Dose	Repeat dose:
Ampicillin	IM or IV	4-10 mg/kg	every 12 hr
Amoxicillin	orally	6-10 mg/kg	every 12 hr
Chloramphenicol	orally	20-50 mg/kg	every 8 hr
Erythromycin	IM or IV	10 mg/kg	every 12 hr
	IM	10-12 mg/kg (young) 2-5 mg/kg (adult)	daily
Penicillin			
G-Procaïne	IM	30,000-40,000 units/kg	daily
G & benzathine	IM	30,000-40,000 units/kg	only once
G & streptomycin	IM	30,000-40,000 units/kg	every 12 hr
Neomycin	orally	5-10 mg/kg	every 12 hr
Spectinomycin	orally	10 mg/kg	every 12 hr
Sulfabromomethazine	orally	130-200 mg/kg	daily
Sulfachloropyridazine	orally	65-95 mg/kg	daily
Sulfadimethoxine	orally	55 mg/kg	1st day
	orally	Reduce dose by 1/2 on second day	
Sulfaethoxypyridazine	orally	200-400 mg/kg	daily
Sulfamethazine	orally	200 mg/kg	1st day
(Sulfadimidine)		Reduce dose by 1/2 on second day	
Other Sulfa drugs	orally or IV	200 mg/kg	every 12 hr
		Reduce dose by 1/2 on second day	
Tetracycline group (all use same dose)			
Chlortetracycline )	IV or IM	6-10 mg/kg	daily
Oxytetracycline )	orally	10-20 mg/kg	daily
Tetracycline HCl )			
Tylosin	IM	2-4 mg/kg	daily

Antibiotics should always be prescribed by a veterinarian. All antibiotics should be given 3 to 5 days at above dosages and times. If no improvement is seen after two days treatment, another antibiotic should be used, if possible.

Table 3. Other Common Drugs

Other drugs	Route to be given:	Dose	Repeat dose:
Aspirin	orally	10-20 mg/kg	every 6-8 hr
Calcium borogluconate (23%)	IV, SQ	1 ml/kg in the first day	once or twice
Charcoal (activated)	orally	2-9 g/kg	as needed
Epinephrine 1:1000	IV or SQ	2-4 ml	as needed (2-4 hr)
Milk of Magnesia	orally	45-60 ml	every 6-8 hr
Mineral oil	orally	100-500 ml	as needed
Oxytocin	IM or IV	20-40 units	as needed (2-4 hr)
Poloxalone (bloat)	orally	100 mg/kg	as needed
Sodium bicarbonate	orally	15-45 g in water	as needed
Vitamin E - Selenium	IM	0.1 mg/kg Selenium 1.36 IU/kg Vitamin E	once per mo once per mo
Magnesium sulfate (epsom salts)	orally	1-2 g/kg	daily
Propylene glycol	orally	200 ml	every 12 hr
Methylene blue liquid or powder for minor wounds			
Iodine 2% liquid for minor wounds			
Iodine 5% liquid for minor wounds			
Iodine 7% liquid for dipping navels			

## TECHNIQUES

### Sterilizing Instruments, Syringes, and Needles

Sterilize all instruments before using. Clean instruments with soap and water after using and before sterilization. Scrub away all grease, blood, and tissue, then rinse with clean water. To sterilize, **boil** in clean water for 15 to 20 minutes. Dry heat and steam can also be used. Remove the instruments from the boiling water and wrap in a clean cloth to keep them clean until used. Wet sterilization in chlorohexadine or one of the quaternary ammonium disinfectants at the proper dilution can be used for surgical instruments just prior to use. **Read label carefully.** Soak instruments at least 20 minutes before using.

**Do not use wet sterilization for syringes and needles.** Residue in the syringe and needle from the disinfectant can cause irritation to the animal and can inactivate some vaccines. Boil syringes and needles instead.

### Injection Sites

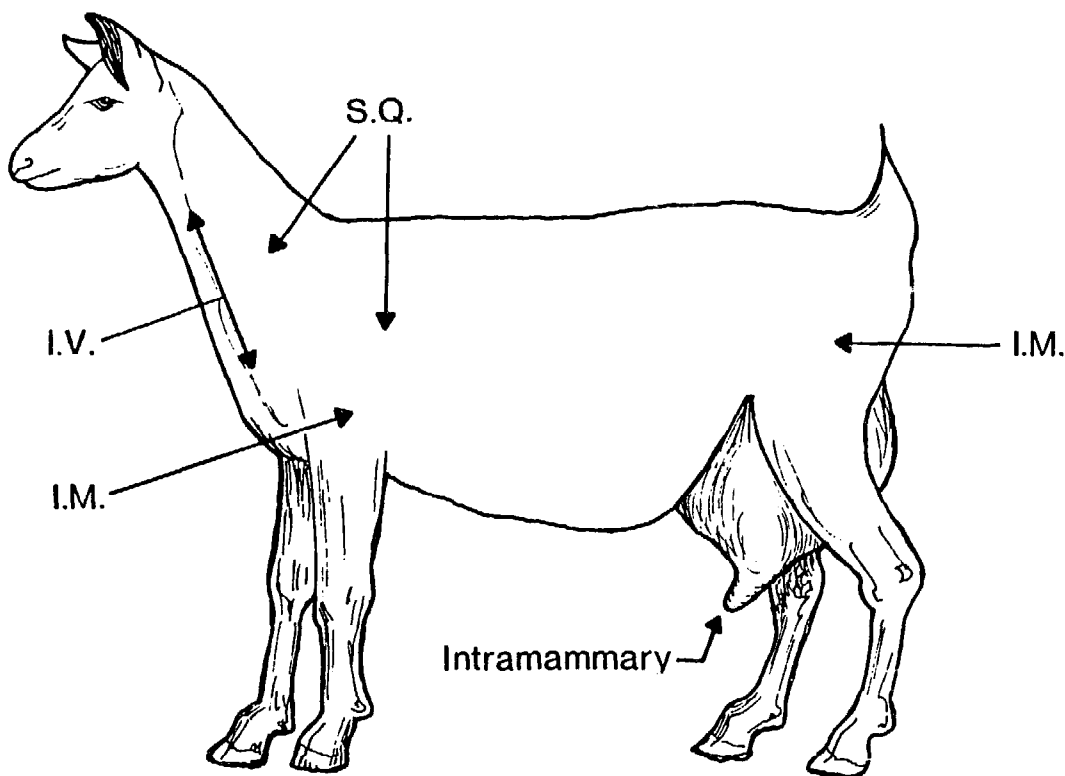
The following abbreviations are for the corresponding type of injection and the site on the goat as shown in the illustration (figure 4).

**Intramuscular (IM)** - injected deep within a major muscle mass, such as that in the hind leg or on the shoulder. It should be given with a 18 gauge, 2.5 to 4 cm needle, pointed straight into the muscle. Before injecting the drug, always withdraw on the syringe plunger to make sure you have not hit a blood vessel. If this happens, blood will flow into the syringe. To correct, simply replace the needle in the muscle.

**Subcutaneous (SQ)** - injected under the skin, usually in the neck or behind the shoulder. Usually a 1 to 2.5 cm needle is inserted at an angle through the skin. So that you do not stick yourself, pick up the skin with your fingers and insert

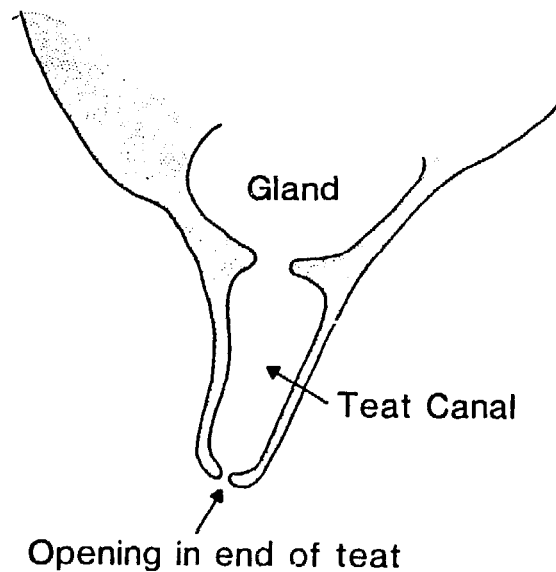
the needle through the skin while it is pointed away from your fingers.

**Intravenous (IV)** - injected into a vein, usually the jugular or neck vein as in the illustration (figure 4). This procedure takes some skill and practice. Become thoroughly familiar with the method before attempting to use it. The vein must be blocked with one hand near the shoulder to enlarge it and make it visible. Usually a 4 cm, 18 gauge needle is used for IV injections. All IV injections should be given slowly, using only products specifically approved for this method. The heart should be closely monitored as heart block may occur.



**Figure 4. Injection Sites**

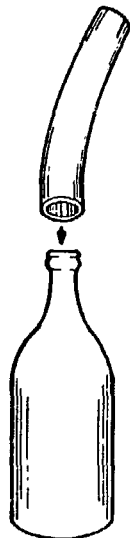
**Intramammary** - injected within the milk gland, into the end of the teat through the natural opening. Always wash the teat end with soap and water and wipe it with alcohol before injection. Use only sterile, blunt, teat infusion needles or "throw-away" mastitis medicine applicators. Unclean material entering the teat will cause mastitis. Figure 5 shows the structure of the teat.



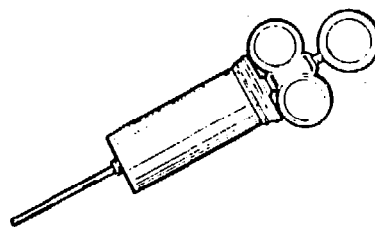
**Figure 5. Intramammary Injection**

**Equipment and Procedures for Giving Medicine by Mouth**

**Drenching** - Most goats will swallow liquids placed into the mouth if their head is held slightly upward. A dose syringe or a bottle with a rubber hose attached (figure 6) will work well.



Slide hose over bottleneck to use as a drench bottle

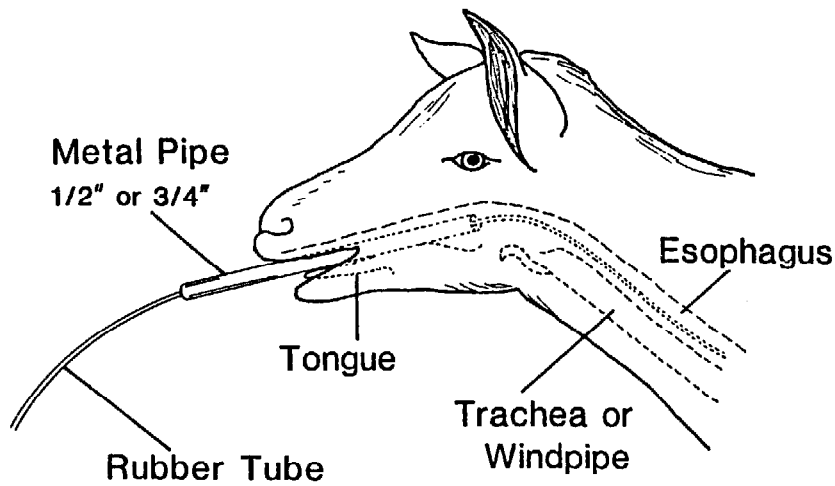


Dose Syringe - for giving liquid to goats

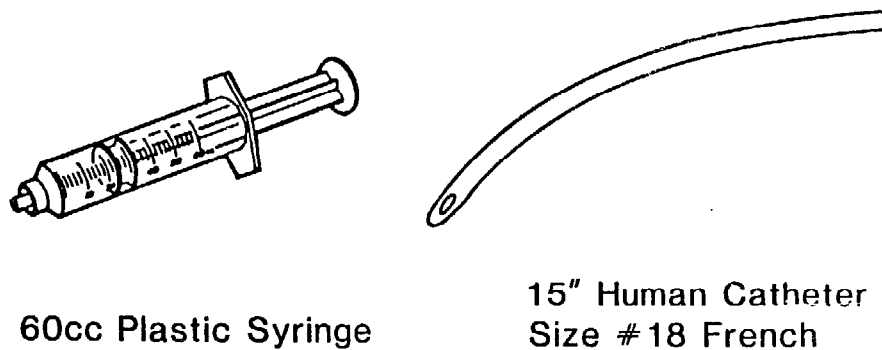
**Figure 6. Bottle with Rubber Hose and Dose Syringe**

Place the end of the tube over the top of the tongue. Be careful not to injure the inside of the mouth. Tasteless liquids such as mineral oil should be given by stomach tube or flavored so that the goat will swallow them.

**Stomach Tube** - This is used to carry liquids (large volumes) into the stomach or to release gas. A 1 to 2 cm rubber or plastic tube can be used. First pass the tube through a metal pipe to clear the goat's jaw teeth and prevent chewing (figure 7). A similar piece of equipment is a small rubber tube, (#18 French catheter) and 60 cc syringe (figure 8), which can be used to place colostrum into the stomach of a newborn kid. A metal pipe to protect the tube is not necessary for newborns.



**Figure 7. Stomach Tube Technique**



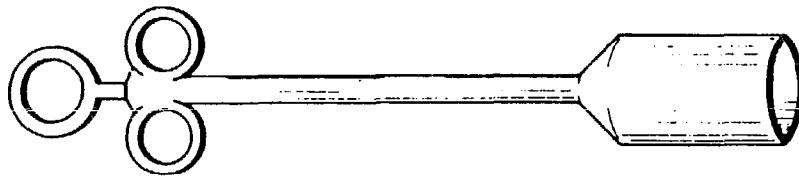
60cc Plastic Syringe

15" Human Catheter  
Size #18 French

**Figure 8. Syringe and Catheter**



**Bolus or Pill Administration** - A small balling gun (figure 9) is used to give pills or boluses to goats. The small guns are passed into the mouth over the hump on the tongue, and the plunger is gently pushed down taking care not to injure the mouth. Goats will often reject boluses, and they must be given again. Be patient. Pills may also be pushed over the back of the tongue with the fingers, but keep your fingers from between the jaw teeth. Do not overextend the head or the bolus may go down the windpipe.



**Figure 9. Balling Gun for Giving Pills to Goats**

**Rumen Inoculation** - When a goat has been sick and has not eaten, the rumen or large stomach becomes sour and lacks the proper bacteria to get started in the digestion process again. Many times the liquid from the stomach of a normal goat, or one that has been recently slaughtered, can be pumped or poured through a tube or drenched into the rumen of the sick goat. This procedure will help many goats that do not want to eat but are otherwise recovering from sickness. Following the stomach tube or drenching technique, use a quart or more of liquid from the rumen of a healthy goat.

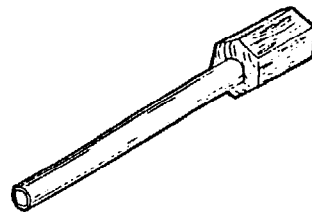
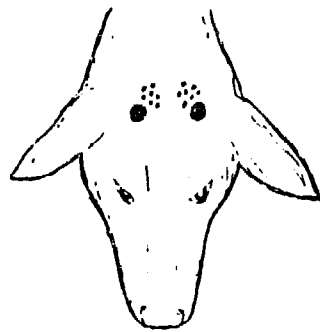
### **Disbudding and De-Scenting**

Injuries from fighting are common in adult goats. Removal of the horns while young (disbudding) is a very effective way to prevent these injuries in adulthood (figure 10). Horns can be removed easily and safely when the kid is less than 3 weeks old. De-scenting of males also can be done at the same time. This will reduce the amount of unpleasant odor from mature bucks.

To remove horns, you will need a steel pipe (2 cm inside diameter) about 46 cm long. Put a

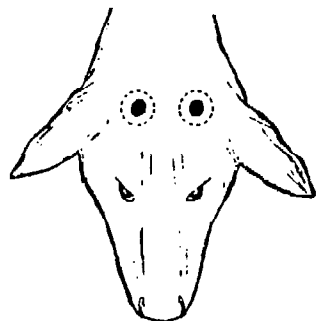
wooden handle on one end so that you can handle it when it is heated, then clip the hair from the horn buds and wash and dry the area. The pipe should be heated red hot by whatever means is convenient and the skin around the buds burned as shown in the diagram. The buds should be burned until they can be scraped off to prevent regrowth. This procedure should be accomplished in about 2 seconds. Longer application can cause brain damage.

Removal can be done without anesthesia on very young kids. If anesthesia is desired, consult a veterinarian. Each kid should receive 150 to 200 International Units (IU) of tetanus antitoxin (T.A.T.) at the time disbudding is done. Also apply an antibiotic powder to the wound and, in areas where screwworms occur, always apply an insecticide or fly repellent.

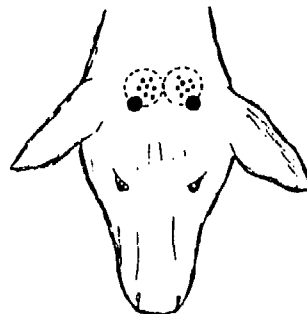


**HORN BUDS**  
 - shaded circles  
**MALE SCENT GLANDS**  
 - dotted area

**WOOD HANDLE**  
**3/4" STEEL PIPE**



To disbud kids burn an area as shown by dotted circle .



To de-scent male kids burn a second circle as shown, after disbudding.

**Figure 10. Disbudding and De-scenting Techniques**

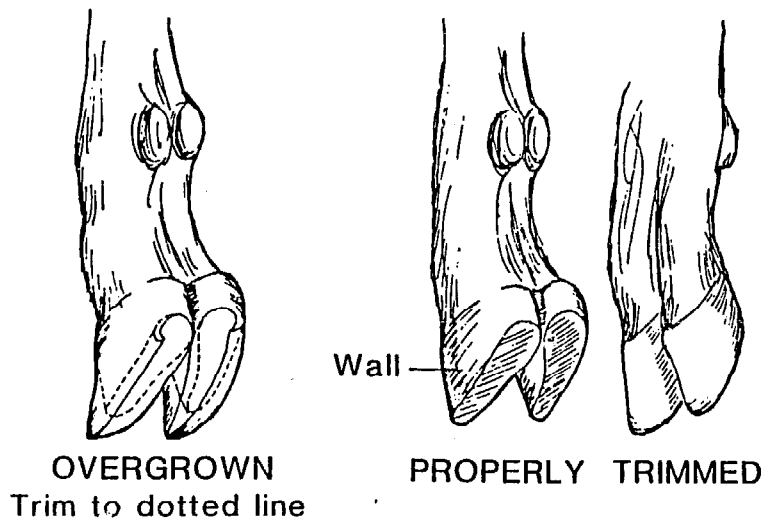
## Castration

Buck (male) kids not wanted for breeding, or that will not be slaughtered for meat at an early age (4 to 6 months), should be castrated at about the time disbudding is done (up to 3 weeks old). The lower 1/3 of the scrotum (sack) is cut off. Place pressure on the testicles above the cut area and force the testicles out of the cut end of the sack. Each testicle should then be grasped, pulled out as far as possible, and cut off. A sharp knife or scissors can be used for this process. Do not handle any tissue that remains in the goat as infection is very likely to occur.

Young kids can be castrated without anesthesia. However, if anesthesia is desired, consult with a veterinarian. Each kid should receive 150 to 200 International Units (IU) of tetanus antitoxin (T.A.T.) at time of castration. If castration, disbudding, and de-scenting are done at the same time, only one dose of T.A.T. is necessary. An antibiotic powder may be applied to the wound. If screwworms are a problem, always apply an insecticide or a fly repellent to the wound.

## Foot Trimming

The sidewall and toes of goat's feet sometimes become overgrown, especially if the animal is housed or not allowed to graze freely. These over-



**Figure 11. Proper Method of Trimming Foot**

grown sidewalls should be trimmed as often as needed to keep the foot flat on the sole and toes pointed as shown. The feet can be trimmed with sheep foot shears, heavy scissors, or a sharp pocket knife. When trimming diseased foot tissue, some bleeding may occur.

### Lancing (Opening) Abscesses

Abscesses, usually caseous lymphadenitis, should be opened when they become ripe or pointed (when the abscess develops a soft center or is slightly raised in the center). First, clean the area to be opened with soap, water, and alcohol. Then stick a needle into the enlarged area. If blood comes through the needle, **stop**, you may have gone through a blood vessel. Remove the needle and try another place. If pus is released, proceed on to the next step. Make a small puncture with a very sharp knife over the softest point, cutting downward toward the ground so that the abscess will drain. Gather all the pus on a piece of paper or cloth and burn or deeply bury the residue. Wash the abscess with water or alcohol, then wash with 7% iodine. Figure 12 indicates the areas most likely to have abscesses.

**Be very careful** when opening abscesses around the head or above the udder; you can easily cut into a large blood vessel or sever a major nerve.

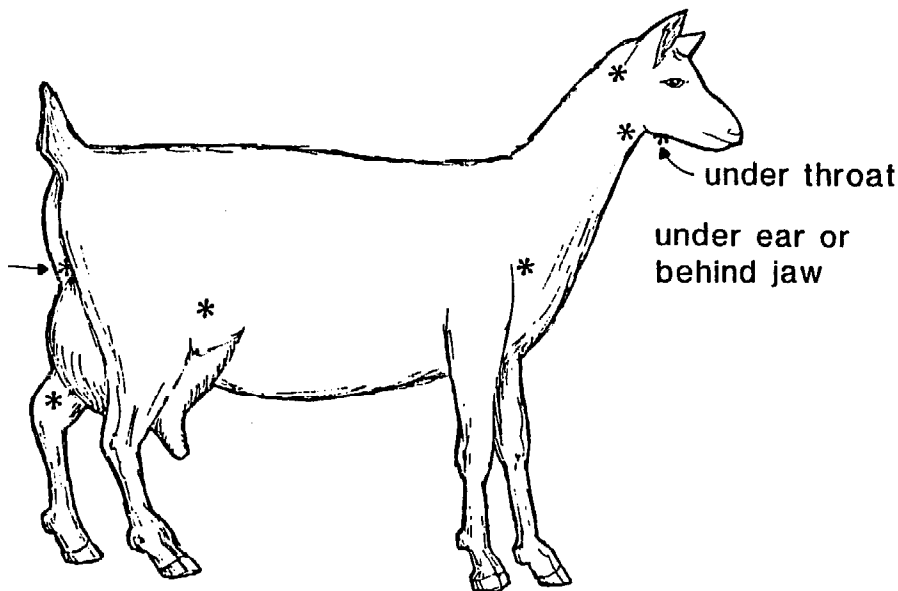
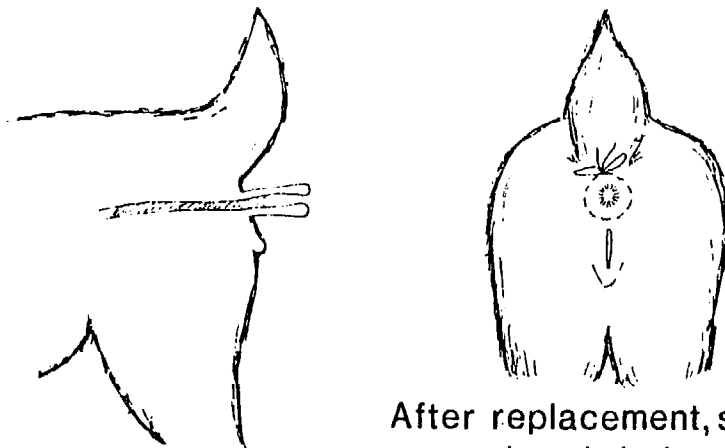


Figure 12. Lymph Nodes Where Abscesses Occur

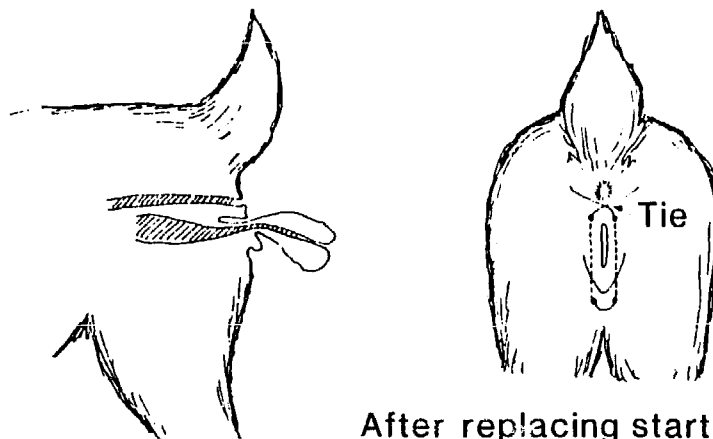
## Rectal and (or) Vaginal Prolapse

The rectum and/or vagina may sometimes be ejected from the body by coughing, from constipation, or difficulty in delivering kids. The condition also may be inherited. All animals that prolapse should be slaughtered. Sometimes it is economical, however, to repair the prolapse so that kids may be raised or the doe may be milked. In this case, the prolapsed tissue can be replaced and stitched. Any type of heavy string, first soaked in alcohol or a disinfectant, can be used (figures 13 and 14). If the tissue is torn, damaged, or has been outside the body for some time, immediate slaughter is usually recommended.



After replacement, stitch around and tie bowknot at top leaving room for bowel movements.

**Figure 13. Prolapse of Rectum**



After replacing start stitch at top, go 1/4" deep under the skin to bottom, out, across and back up.

**Figure 14. Prolapse of Vagina**

## BIRTH AND THE NEWBORN

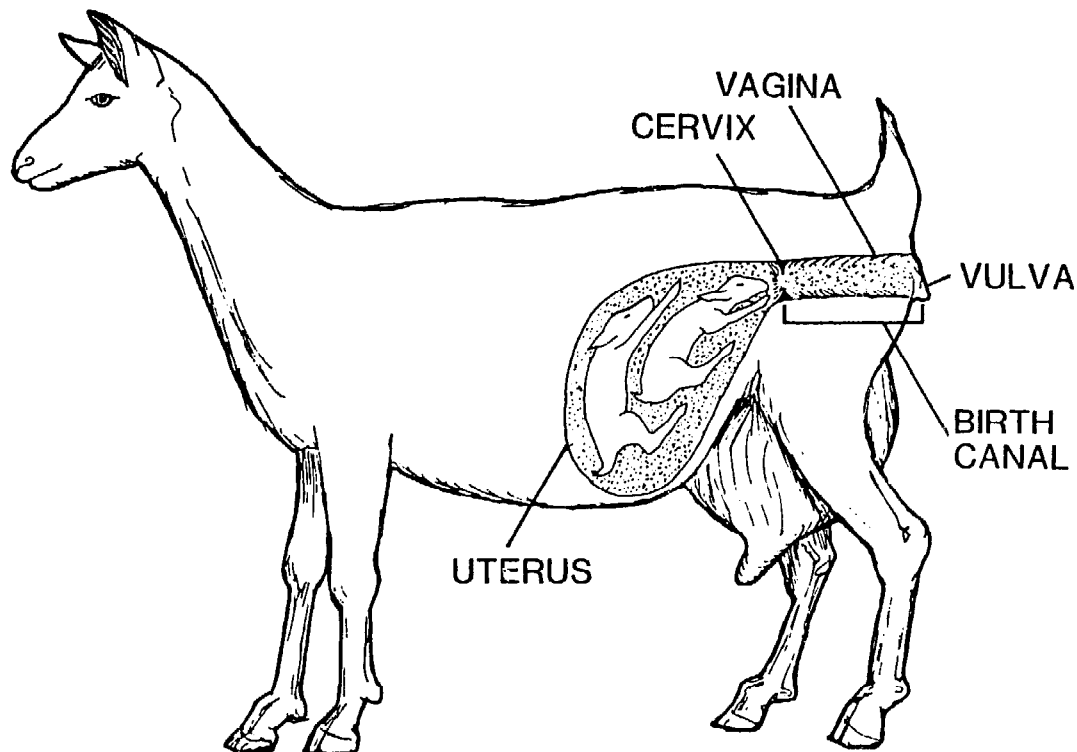
### Birth Stages, Procedures and Complications

Most does deliver their kids without assistance after about 150 days of pregnancy. You should know the normal delivery time and procedure so as not to interfere with or injure the reproductive tract of the doe. Many does that do not re-breed may have been damaged at a previous kidding, which is the result of poor human management.

The doe should be in good physical condition, but not fat, at kidding time. She should be full bodied, muscles filled out, and smooth over her ribs and top line. Proper feeding is necessary during her milk-producing period as well as during the dry period before kidding, especially to prevent pregnancy toxemia or ketosis. Daily exercise is also very important.

When delivery time is due, a very clean place should be available. The doe may be placed in this area about 1 day before she is due, if due date is known. Do not keep her there much longer because of the build up of filth. Provide dry bedding to absorb the fluids that are produced with the birth process.

**Phase I** involves relaxation of the pelvis, initial contractions of the uterus, and dilation of the cervix (figure 15), which enlarges the birth canal and eases delivery. During this time, the udder will become greatly enlarged and the teats will fill. This can occur several days before time to deliver. The vulva will become slightly red, everted or slightly rolled outward, and moist. Usually the doe will have a depressed appetite. She may appear restless and paw the ground and bleat. This phase may require more than 1 day. Usually the "water bag" ruptures near the end of this phase.

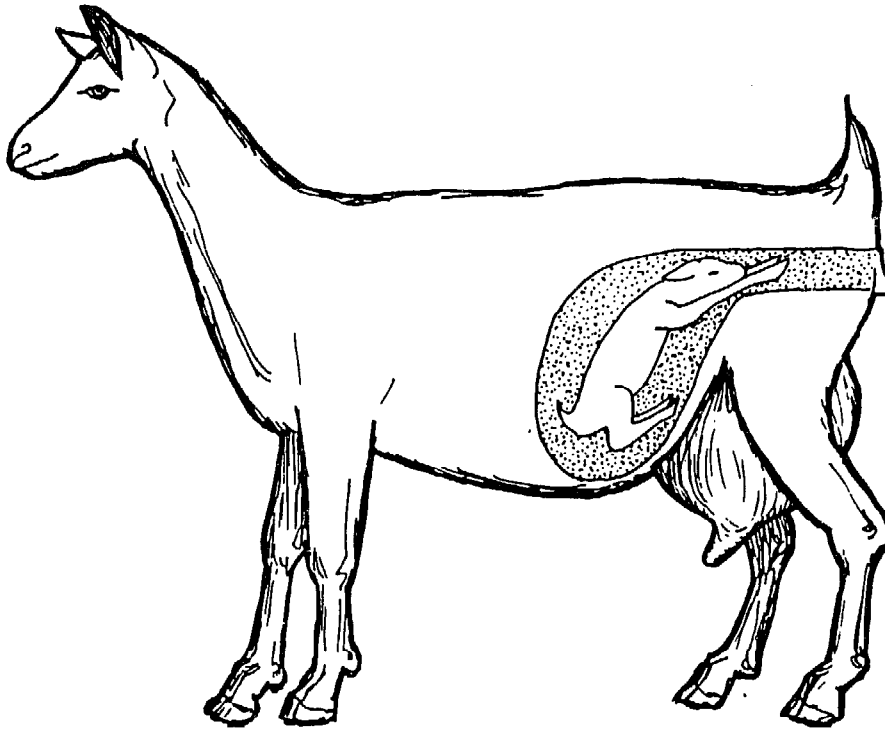


**Figure 15. Normal Positions and Locations of the Reproductive Tract of the Goat**

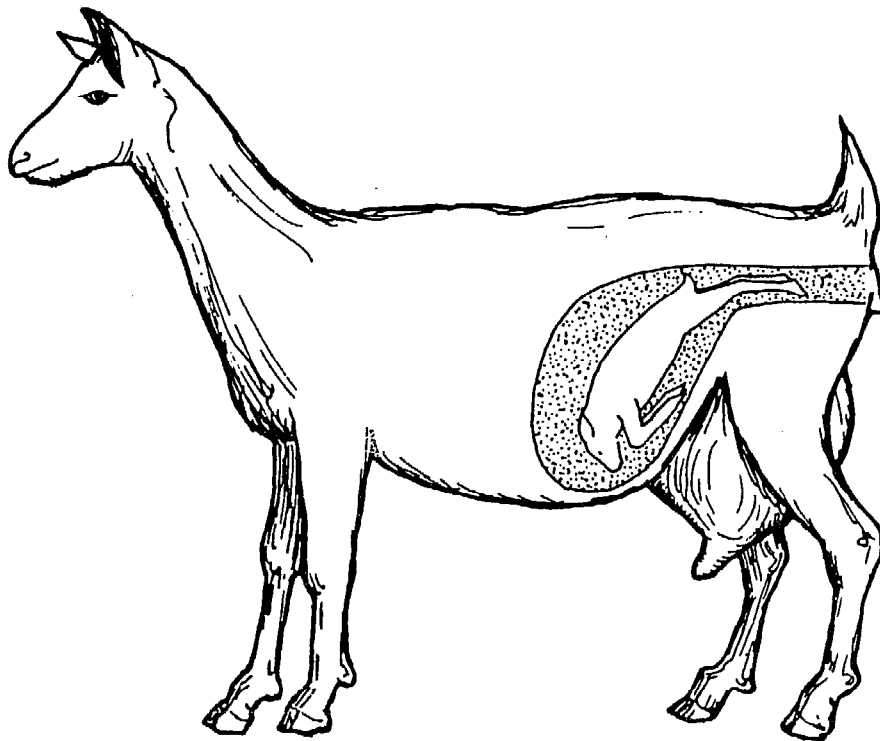
**Phase II** is the actual delivery of the kid. It starts with the entry of the kid into the birth canal. With this entry pressure, the doe begins to strain, pushing with the abdominal muscles. This phase should never last more than 1 hour. The kid is usually delivered within 15 minutes. As a good rule of thumb, if the kid has not been delivered within 15 minutes of hard straining, you should examine the doe. If delivery cannot be made with assistance within 45 minutes, you should seek veterinary assistance. You should watch the doe continuously during this phase. If delivery does not occur within 1 hour, the cervix may contract and make birth impossible except by surgery.

Kids are delivered in many different postures or positions, two of which are absolutely normal: 1) the anterior position, with the head lying on the forefeet, the chin resting on or about the knees, and the kid's back up (figure 16); and 2) the posterior entry with both rear legs into the birth canal and the kid's back toward the doe's back (figure 17). Usually the posterior position

takes a little longer for delivery. Abnormal positions are discussed later.



**Figure 16. Normal Anterior Presentation**



**Figure 17. Normal Posterior Presentation**



**Phase III** is a clean-up phase which, after a normal delivery, requires up to 2 weeks. It consists of 1) delivery of the afterbirth (which usually requires a maximum of about 12 hours), 2) reduction of the uterus to normal size (which may take up to 2 weeks), and 3) emptying of extra fluids from the uterus. Most fluids are gone by the time the afterbirth or placenta falls out. However, it is normal to have a slightly bloody to clear discharge for up to 2 weeks after kidding. Problems that might occur in phase III are 1) retention of the afterbirth for longer than 24 hours, 2) a pus-like discharge occurring within 2 to 3 days after kidding, or 3) a reddish discharge increasing in volume, having a foul smell, or containing pus. If you see these symptoms, consult a veterinarian or, if not available, begin use of antibiotics such as penicillin or tetracycline.

### **Problems With Delivery**

Difficult delivery (dystocia) can occur when the kid is not in one of the previously described normal positions (figures 16 and 17), when the doe has a small or injured pelvis, or when a kid is very large. Problems also occur if a kid dies before birth; usually the kid's head is out of position (down or to one side). A small, light nylon cord is very helpful in correcting head position. When you encounter a problem delivery, follow these steps:

1. Wash the doe's vulva and area around it with mild soap and warm water.
2. Wash your hands and arms similarly.
3. Lather your hands well, using the mild soap as a lubricant. Very gently enter the vagina with your hand.
4. Feel and identify the parts of the kid that are in the birth canal. Make sure legs, head, and body parts all belong to the same kid. Remember multiple births are common in goats. To deliver a kid in the forward position, you must have at least one front leg and the head in the canal. Ideally, you should have both

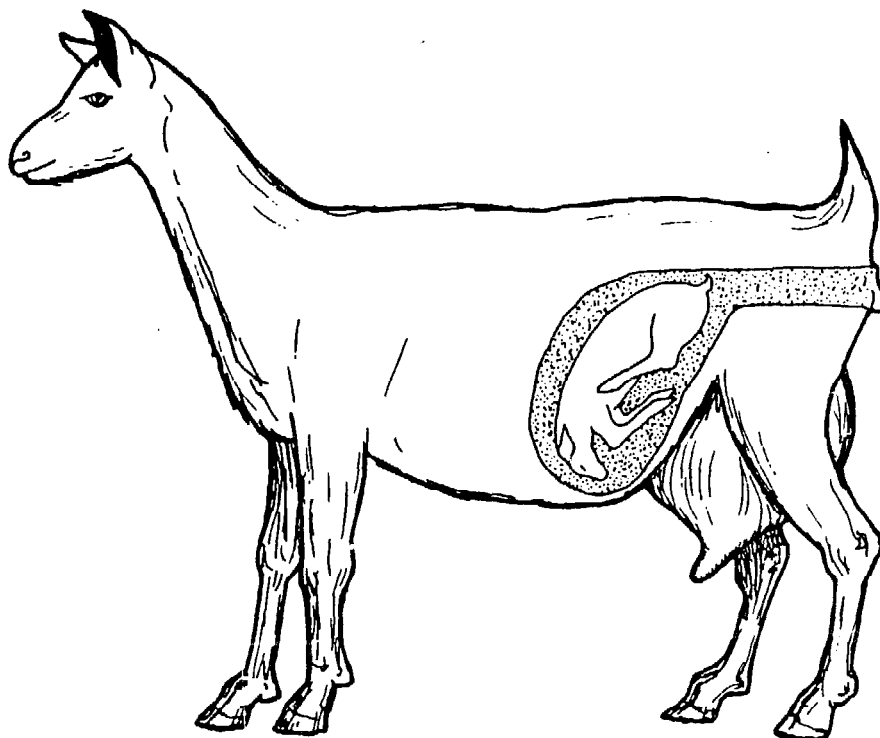
front legs and the head. If you do not feel both front legs, reach further into the canal to find the other leg and gently pull it into place. A gentle but firm pull should bring the kid out. If the delivery is posterior, both hind legs must be in the canal. Check to be sure that these are rear legs and not the forelegs with the kid's head to one side. If the toes point **upward** and the kid's back is **upward**, those are front legs. If the back is **upward** and the toes point **downward**, then they are rear legs. Also feel the hocks. If they point upward, you have the rear legs.

5. If some part of the kid's body is not in proper position, you can very gently feel to determine where it is located, then carefully position it where it belongs. A small cord is helpful to pull the legs or the head into position. To be safe, it is a good idea to pull only with your hands. The strength a person has in his hands and arms is all the pressure than can safely be applied to the goat.
6. After the kid's body parts are in position, pull firmly and gently to deliver the kid.
7. Make sure all membranes are cleared from the nostrils so that the kid can breathe. Sometimes tickling the inside of the nose with a small straw will stimulate the breathing reflex. If a lot of mucus is in the kid's nose, hold the kid by the rear legs and swing it carefully. Do **not** attempt mouth-to-mouth or mouth-to-nose resuscitation because of the possibility of disease transmission, especially if brucellosis is a problem in the area.
8. After the kid is breathing properly, hold it up and dip the navel stump in 5 or 7% iodine to stop the entrance of bacteria. In areas where screwworms are a problem, it is advisable to also apply an insecticide or insect repellent.
9. Let the doe lick the kid and dry him off. Watch to see if it stands up and make sure it nurses within 3 to 6 hours. See the disease section on hypogammaglobinemia.

10. If the kid is to be raised separately from the doe, do not separate them until the next day to ensure adequate colostrum intake. Keep the kid in a dry and draft-free area with sufficient ventilation to remove moisture and gases.

### **The Breech Presentation**

Special problems are caused by the breech position (figure 18). The rump of the kid is pushed into the birth canal and its rear legs are pointed forward. In this case, all you will feel is the hindquarters and tail of the kid. Push the body of the kid forward until your hand is able to grasp its hock. Raise the hock upward and outward and with one or two fingers try to rotate the foot of the kid toward the opposite side. For example, with the right leg, rotate the hock to the right and push the foot to the left and bring it backward until it is straight and out. Repeat the same procedure, but raise the left hock up and to the left while pushing the foot to the right and then back. Then, with both of the kid's feet in the proper posterior position, gently pull the kid from the doe.

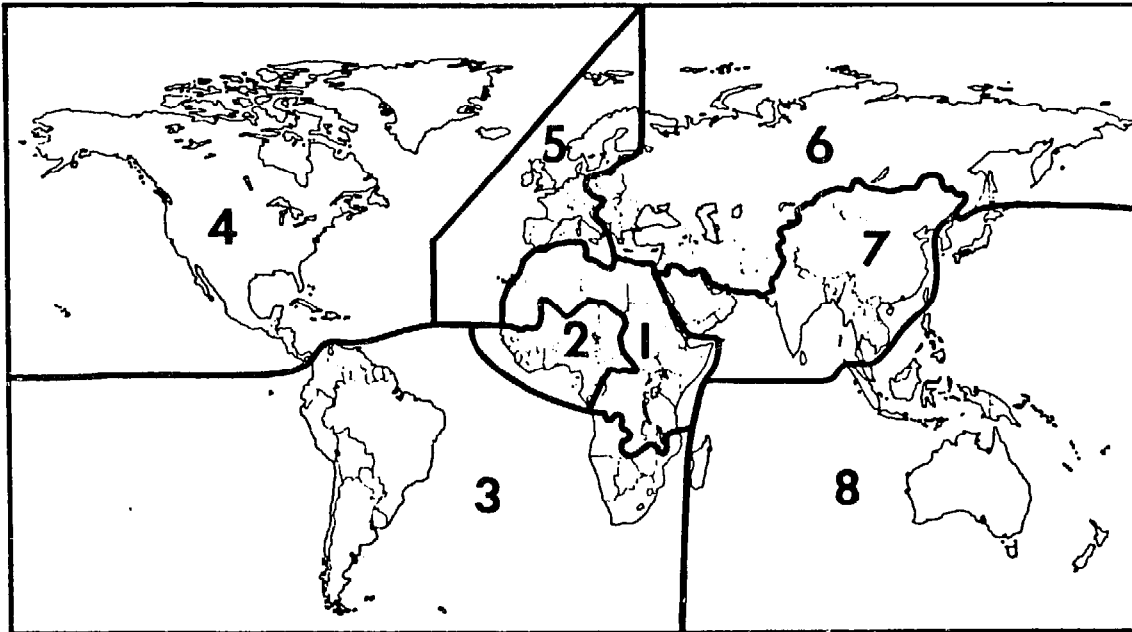


**Figure 18. Breech Position**

## Removal of Afterbirth

If the doe has not shed her afterbirth within 24 hours after the kidding, grasp the tissue hanging from the vulva and pull gently. If the tissue does not pull loose, give the doe an IM dose of an antibiotic (penicillin or tetracycline). Then wait and try to remove the membranes the next day. Do **not** put your hand into the reproductive tract and **do not** pull hard enough to tear the tissue. With medication and time, the membranes can be withdrawn. Wear rubber or disposable gloves, if possible.

## MAP OF WORLD REGIONS WHERE NO INCIDENTS OF SPECIFIC DISEASES HAVE BEEN REPORTED



According to the Animal Health Yearbook, 1978-FAO-WHO-OIE, the following regions do not report any incidence of the listed diseases.

- |   |  |
|---|--|
| <p><b>Region 1</b><br/>Meliodosis</p> <p><b>Region 2</b><br/>Contagious Agalactia<br/>Nairobi Sheep Disease<br/>Rift Valley Fever<br/>Scrapie</p> <p><b>Region 3</b><br/>Contagious Agalactia<br/>Contagious Caprine Pleuropneumonia<br/>Meliodosis<br/>Nairobi Sheep Disease<br/>PPR<br/>Rift Valley Fever<br/>Scrapie</p> <p><b>Region 4</b><br/><i>Babesia</i> - United States and Canada<br/><i>Brucella melitensis</i> - United States and Canada<br/>Contagious Caprine Pleuropneumonia<br/>Foot and Mouth Disease<br/>Heartwater<br/>Meliodosis<br/>Nairobi Sheep Disease<br/>PPR<br/>Rift Valley Fever<br/>Sheep/Goat Pox<br/>Trypanosomiasis</p> <p><b>Region 5</b><br/>Anaplasmosis<br/>Contagious Agalactia<br/>Foot and Mouth Disease - United Kingdom<br/>Heartwater<br/>Meliodosis<br/>Nairobi Sheep Disease<br/>PPR<br/>Rabies - United Kingdom<br/>Rift Valley Fever<br/>Sheep/Goat Pox<br/>Trypanosomiasis</p> | <p><b>Region 6</b><br/>Contagious Agalactia<br/>Heartwater<br/>Meliodosis<br/>Nairobi Sheep Disease<br/>Rift Valley Fever<br/>Trypanosomiasis</p> <p><b>Region 7</b><br/>Contagious Agalactia<br/>Heartwater<br/>Nairobi Sheep Disease<br/>Rift Valley Fever</p> <p><b>Region 8</b><br/><i>Anaplasmosis</i> - New Zealand<br/><i>Babesia</i> - New Zealand<br/><i>Brucella melitensis</i><br/>Contagious Agalactia<br/>Contagious Caprine Pleuropneumonia<br/>Foot and Mouth Disease - Australia and New Zealand<br/>Nairobi Sheep Disease<br/>PPR<br/>Rabies - Australia and New Zealand<br/>Rift Valley Fever<br/>Scrapie<br/>Sheep/Goat Pox<br/>Trypanosomiasis - Australia and New Zealand</p> |
|---|--|

## OTHER SOURCES OF INFORMATION ON DISEASES OF GOATS

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- Diseases and Parasites of Livestock in the Tropics, 1977. M. T. B. Hall, Longman, New York, NY 10036, U.S.A.
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- Proceedings Third International Conference on Goat Production and Disease, Tucson, January 10-15, 1982. Dairy Goat Journal Publishing Company, P.O. Box 1808, Scottsdale, AZ 85252, U.S.A..
- Proceedings 1976, 1979, American Association of Sheep and Goat Practitioners. c/o Dr. Don E. Bailey, Secretary-Treasurer, 248 N.W. Garden Valley Road, Roseburg, OR 97470, U.S.A.

### Institutions

- Agriculture Department or Ministry Officials in the country you are working in.
- Winrock International Informational Services, Morrilton, AR 72110 USA

### Local or District Veterinarian

## GLOSSARY

**Abscess** - an enlargement or pocket filled with pus either within the body or under the skin.

**Acute** - rapid onset of illness, usually measured in hours, to a day or two.

**Arthritis** - an inflammation or disease of the joints. Arthritic refers to arthritis.

**Anemia** - A decrease of red blood cells caused by blood loss or inability to produce red blood cells.

**Anterior** - toward the head.

**Antibiotics** - a drug derived from a living organism, used to suppress growth of or kill an organism (bacteria, chlamydia, or rickettesia).

**Antibodies** - particles of material that aid in protection from disease.

**Antiserum** - an immunizing agent made from blood serum. It provides a short-lived immunity, usually no more than 30 days.

**Bacterin** - a vaccine prepared from dead bacteria or their products.

**Bicarbonate ion** - salts containing the  $\text{HCO}_3$  anion as obtained from sodium bicarbonate or baking soda. Used to keep the blood from becoming too acid.

**Chronic** - a long period of illness measured in days to months or years.

**Colostrum** - the first milk of animals after the birth of their young. It is high in antibodies and protects the young from disease until they are old enough to produce their own antibodies.

**Contagious** - a disease capable of being transferred from one animal or person to another.

**Cornea** - the clear part on the front of the eyeball.

**Dehydration** - loss of water from the body. This is a very critical situation: over 12% dehydration results in death.

**Electrolyte** - normal chemical particles in the blood that are capable of conducting electricity and needed to maintain natural cell balance. The electrolyte ions are sodium, potassium, chloride, and bicarbonate.

**Emaciation** - a wasted, excessively lean condition of the body.

**Encephalitis** - inflammation or infection of the brain by an organism.

**Fecal** - See feces.

**Feces** - manure (waste from the gut).

**Fetus** - unborn young.

**Gangrenous (mastitis)** - dead, dry, rotten tissue that has no blood supply and shows no reaction to pain.

**Genital** - referring to the reproductive organs.

**Gestation** - period of time for fetus development from conception to birth; about 150 days in goats.

**Heat (estrus)** - period of time that the female is fertile and will accept the male for breeding.

**Host** - an animal on which a parasitic organism depends for its life. The parasite may live on or within the host.



**Immunity** - security against the development of a particular disease. High resistance to a disease.

**IU** - International Units

**Infectious** - the ability of an organism such as a virus or bacterium to multiply in an animal and cause disease.

**Intramuscular (IM)** - refers to placing or injecting a substance into a muscle or muscle tissue.

**Intravenous (IV)** - refers to placing or injecting a substance into a vein.

**Ketone Bodies** - by-products of fat breakdown found in the blood and urine.

**Lancing** - to cut or incise, as to lance an abscess or boil.

**Lesions** - an abnormal change in structure of an organ or part due to injury or disease.

**Lymph Node** - normally a small mass of tissue associated with the lymph system; drainage system primarily containing white blood cells that help fight diseases.

**Mastitis** - an inflammation or infection of the mammary gland.

**Metabolic Disease** - those diseases that involve the lack of or unusual breakdown of physical and chemical processes in the body.

**Mucous Membrane** - tissue lining the inside surface of the mouth, throat, eye, reproductive tract, and anus.

**Mummified Fetus** - a dead, dried fetus, usually carried to term or later.

**Noninfectious disease** - one not caused by a biological organism.

**Oocyst** - a developmental stage of coccidia, passed in the feces, that contains many infective particles.

**Organism** - any living matter such as a bacteria, virus, parasite, etc.

**Parasite** - an organism that lives on or within another animal (host), benefitting at the host's expense.

**Peracute** - extremely rapid onset and period of illness, usually measured in minutes or hours.

**Pneumonic** - refers to the lungs or pneumonia.

**Posterior** - toward the rear.

**Postmortem Exam (Necropsy)** - an examination done upon a dead animal.

**Respiration Rate** - movements of air from the lungs measured in rate per minute; one in-and-out movement counts as one respiration.

**Rickettsia** - an organism that lives on or in red blood cells; a blood parasite.

**Rumen** - the first stomach in the ruminant animal, a large compartment that stores roughage or forage while the contents are being digested or broken down by bacterial action.

**Rumen Movement** - in the digestive process, the rumen moves to shift and mix the material eaten by the animal. Each of these movements can be seen or felt on the left side of the animal. They can be counted to evaluate the health and function of that organ.

**Ruminant** - an animal that has a four-compartment stomach, including cattle, sheep, goats, buffalo, deer, antelope, camels, etc.

**Secretions** - normal or abnormal fluids coming from a body organ. Tears are secretions of the eyes.

**Seizures** - fits, convulsions, or other central nervous system dysfunctions.

**Silage** - moist, fermented plant material that has been stored in an airtight environment and is used as feed for ruminants.

**Spleen** - an organ within the body that serves as a blood reservoir and aids in the breakdown of red blood cells.

**Spore** - a very hardy, dormant, or inactive form of bacterial or fungal life.

**Stillbirth** - a fetus born dead.

**Subclinical mastitis** - infected udder that does not always show symptoms.

**Subcutaneous (SQ, Sub. Q.)** - refers to placing or injecting a substance under the skin.

**Three-Host Tick** - a tick that spends each of three separate parts of its life cycle on a different host.

**Toxoid** - an immunizing agent against toxins produced by bacteria.

**Ulcer** - a raw, red, eroded area occurring on a mucous membrane or on the skin.

**Vaccine** - a biological product that is injected into an animal to stimulate an immunity to a particular disease. It can contain live, modified live, or killed organisms.

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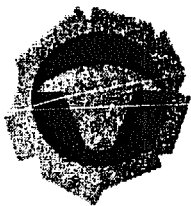
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