nated in the fall to insure protection during the fall and winter. Some cattle owners in badly infected areas follow the practice of vaccinating every 6 months all animals between the ages of 2 and 10 months.

A product known as antiblackleg serum is sometimes used for immunizing valuable calves exposed in outbreaks. This product immediately increases the animal’s resistance to blackleg, but the type of immunity it confers ceases after about 2 weeks.

In some blackleg districts where the soil is also believed to be infected with the organism that causes malignant edema infection in animals, a bivalent or mixed bacterin containing both organisms and known as *Clostridium chauvoei-septicus* bacterin has been used for the prevention of both blackleg and malignant edema.

Recognized control measures in outbreaks of blackleg include:

- The isolation and treatment of all animals showing early symptoms of the disease;
- The vaccination of apparently well but exposed animals and, if feasible, their immediate removal to a new pasture on higher ground;
- The prompt disposition of dead animals by complete burning or deep burial in quicklime;
- The destruction of manure, bedding, and other contaminated material by burning;
- The cleaning and disinfection of contaminated stables; and
- The rigid enforcement of restrictions against skinning dead animals, feeding the carcass to other animals on the farm, and removing the carcass from the premises to a rendering plant.

When a suspected outbreak of blackleg occurs, a veterinarian or the State livestock sanitary official should be promptly notified.

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**Actinomycosis and Actinobacillosis**

A. W. Monlux and C. L. Davis

Many swellings or growths found in the tissues of the head and throat of cattle are diagnosed as either actinomycosis or actinobacillosis. The two infections were regarded as a single disease until the 1930’s.

Investigators finally proved that an infection designated as actinobacillosis is found in the softer tissues (lymph nodes, tongue, lungs, and the deeper layers of the skin) and is amenable to treatment. It is caused by the microorganism, *Actinobacillus lignieresii*, which lives only in the presence of oxygen.

Research groups also established that actinomycosis generally is localized in bone (usually the maxilla and mandible, or jaws) and that recurrence of the infection often follows therapy. An anaerobic micro-organism, *Actinomyces bovis*, which is more closely related to fungi than to true bacteria, produces these lesions involving the jaws.

Veterinarians now use the sulfona-
mides, antibiotics, iodides, and surgery to treat both diseases. Healing of the lesions of actinobacillosis usually can be expected after proper therapy. Reports indicate that streptomycin has produced more rapid clinical improvement in cases of actinomycosis than one would expect with iodide medication. However, substantiated claims of permanent cures of an actinomycotic infection with this antibiotic have not appeared in the veterinary reports.

No method of immunization for either infection has been devised. Veterinarians report epizootics of actinobacillosis among young feeder cattle on individual farms and ranches, particularly in the Western States. The records of the Meat Inspection Branch indicate that observed infections of actinobacillosis and actinomycosis in cattle are tabulated together in their inspection procedures. They represent a cause for condemnation in cattle that exceeds any other individual condemnation for any disease or condition. During the fiscal year that ended June 30, 1953, the two diseases were reported to occur in 200,645 cattle and calves out of 21,231,784 slaughtered. Parts (usually the head) of the carcases were condemned; 807 entire carcases were considered unfit for food for people.

Actinomycosis, commonly known as "lumpy jaw" or "big jaw," usually involves the bones of the head, particularly the lower jaw. Actinomycotic infections of the softer tissues occur in cattle but are rare. Large, pus-filled tracts or cavities (abscesses) form when the infection spreads through the bone. Connective and other body reparative tissues in and near the bone grow abundantly in an attempt to wall off the abscess. By the time the infection has extended from the bone to the soft tissue and skin to establish a fistula or drain for the lesion, the involved parts of the jaws may be enlarged 2 or 3 times.

Fistulas from abscesses of the bones of the head sometimes extend inward and discharge into the pharynx or mouth. The palate and gums next to the bones often are swollen and inflamed. The teeth may loosen.

Small, hard, yellowish granules, called "sulfur granules" or "rosettes," are present as tiny grains in the pus from abscesses of both actinomycosis and actinobacillosis. They are barely visible to the unaided eye. All the granules look alike when viewed under a microscope. Many small, clublike bodies are arranged around a colony of micro-organisms, like the petals of a flower. This microscopic resemblance to a rose is responsible for the designation of the granules as "rosettes." The actinomycotic rosettes are usually 2 or 3 times larger than those of actinobacillosis.

An accepted diagnostic procedure is to crush large numbers of washed granules on a slide and stain the prepared slide with a Gram stain. Gram-positive micro-organisms, which may be seen either as short rods, filaments, or branching forms, are identifiable microscopically in typical cases of actinomycosis. The actinobacillosis micro-organisms can also be demonstrated by a similar treatment of its rosettes and is characteristically a short, Gram-negative bacillus.

Bacteriologic cultural studies of the lesions can be made as a supplemental and conclusive diagnostic procedure for each disease. Results of such examinations are never available for several days or weeks. Experienced diagnosticians usually can predict accurately which specific micro-organism will be isolated in bacteriologic studies by the microscopic examination of the stained smears of crushed rosettes.

Actinobacillosis of the head and neck region often can be recognized easily in a herd of cattle, as there may be swellings under the skin, which can be moved with the fingers and may be as big as a walnut or an egg, or even
larger. A livestock owner who inspects his cattle every week generally notes a progressive increase in the size of the growths.

One or more lymph nodes of the neck may be abscessed. These growths usually are more firm and located deeper in the soft tissues. Sometimes "chains" of enlarged lymph nodes can be palpated as the infection spreads down the neck. Firmness of both the subcutaneous and lymph nodes lesions is also related to the amount of connective tissue deposited in and around them and invariably increases as the growths become older.

These older, fibrotic growths may become partially calcified. The abscessed enlargements of the subcutis often break through the skin, discharging pus. The most common manifestation of the disease in slaughtered cattle are abscesses of variable sizes in the cervical (neck) lymph nodes, which one may not be able to detect in the live animal.

The tongue may be affected, but less often than the lymph node and subcutaneous tissues. Abscesses and ulcers may occur in or near the groove on the upper surface of the tongue. When the tongue is extensively involved, a marked increase in the fibrous tissue of the organ (fibrosis) results. The tongue then becomes increasingly hard and immobile and may protrude from the mouth—hence the term "wooden tongue." The animal will have great difficulty in eating and drinking.

An infection with actinobacillosis may produce a polyp, or pendulous type of growth, in the pharynx, larynx, or upper respiratory tract. Interference with swallowing and breathing is sometimes very noticeable in such cases. The growth often can be removed by surgery.

Besides the head and neck, actinobacillosis has been reported in almost every organ and tissue in cattle. Lung, liver, kidney, spleen, brain, mammary gland, testis, salivary gland, forestomach, intestine, and lymph node and subcutaneous tissue (other than that of the head and neck) are some of the sites where the infection has been found.

Cases with extensive lesions on the internal lining of the body cavities (pleura, peritoneum) are quite spectacular to see and have been the subject of several published reports.

The occurrence of actinobacillosis varies in different sections of the United States, but generally it seems to be 5 or 6 times as prevalent in cattle as actinomycosis.

Natural infections with actinobacillosis are also found in sheep, swine, deer, and other wild animals, but not so often as in cattle. Laboratory animals, including rats, mice, guinea pigs, and rabbits, are difficult to infect by the inoculation of cultures of Actinobacillus lignieresi.

Few cases of actinobacillosis in man have been reported. Actinomycosis, on the other hand, has been found in man, mostly among young and middle-aged males. Actinomycosis is also diagnosed in swine, sheep, horses, dogs, and many species of wild animals.

A significant discovery, first reported in 1905, was that micro-organisms identical to Actinomyces bovis were present in the tonsils, teeth, and mouth in man as a part of the normal bacterial flora. Scientists subsequently have substantiated the findings and have noted that lesions of actinomycosis could be produced in cattle and hogs by the inoculation of cultures isolated from human tonsils.

There is a need for thorough investigations of the bacterial flora of the tonsils and mouth cavity of cattle. D. J. Davis, in a study in 1923 at the University of Illinois, made a bacteriologic investigation of the micro-organisms which could be recovered from a group of supposedly normal and representative human, bovine and swine tonsils. He found Actinomyces bovis in the human and swine tonsils but not in the bovine. His work provided a logical explanation for the high incidence
of actinomycosis of the udder in sows. The infection is now thought to enter from the mouths of suckling pigs through wounds made by their teeth.

Abrasions or lacerations in the oral cavity in cattle are believed to be the primary portal of entry for infections of actinomycosis and actinobacillosis. Dry, harsh, rough feeds may cause injuries to the mouth. Particles of hay or grain, especially the barbed awns of barley and bearded grasses, often are found in the oral lesions and sometimes are covered with a growth of either *A. bovis* or *A. lignieresii*. In such cases, the vegetable particles probably acted as a foreign body about which the organisms grew. Neither of the two microorganisms has ever been reported on such material except when it has been incorporated into abscesses in the living animal.

Teething may be the explanation for the more frequent occurrence of both infections in young cattle. Lacerations, swelling of the gums, and the trapping and decay of foodstuffs in the oral cavity accompany the eruption of the permanent teeth during the first 3 years of life of the domestic bovine animal.

**Preventive Measures** that can be adopted to reduce actinomycosis and actinobacillosis infections have been limited to the application of basic concepts of animal sanitation. The only proved transfer of infection from one animal to another is by the inoculation of diseased tissues or cultures.

Animals of all species affected with either disease should not be permitted to remain in pastures or feed lots with healthy cattle. This will prevent pus from open lesions from contaminating food, water, bedding, or cuts and abrasions in noninfected animals.

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**Anaplasmosis of Cattle**

**JOHN C. LOTZE, DANIEL W. GATES, AND T. O. ROBY**

**Anaplasmosis**, sometimes called gall sickness, is a disease of cattle that is marked by anemia and fever and microscopic parasites in the red blood cells.

It is infectious and transmissible. It occurs the world over and is especially troublesome in the warmer regions.

The causative agent, *Anaplasma marginale*, apparently belongs to the Protozoa, a group of minute, one-celled animals that includes such organisms as the causative agents of coccidiosis and malaria.

The first account of the disease now known as anaplasmosis is contained in the famous report by Theobald Smith and Fred L. Kilborne on the cause and method of transmission of so-called Texas or southern cattle fever, published in 1893 (Bulletin No. 1, Bureau of Animal Industry). In this report are