holding down calculi formation. The enzyme has been used with some success as an aid in voiding or eliminating stones.

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Tumors

C. L. DAVIS AND W. T. SHALKOP

ANIMALS may be subject to different types of tumors, which can be said to have essentially the same cellular makeup, grow and spread in much the same way, and follow a similar clinical pattern as tumors in man.

Practically all the body tissues and organs in animals are susceptible to the formation of tumors, which may be benign or malignant. The term "cancer" has come by usage to designate any malignant tumor that may endanger life, whereas "benign" or "noncancerous" means "innocent" in that the life of the individual is not necessarily threatened.

Some differences exist. In food-producing animals the rare occurrence of cancer of the stomach, colon, mammary gland (breast), and prostate are in sharp contrast to the frequency in which those organs are affected in human beings.

Primary cancer of the lung, which is considered to be rather common in man, is seldom seen in animals. Tumors in the bovine lung are much less frequent than malignant growths elsewhere in the body, principally from cancer of the eye or uterus. Tumors in animals, as in man, become more prevalent with increasing age.

THE MOST COMMON SITE of cancerous involvement in cattle is the eye or its appendages. As the lesions become larger, they are exposed to trauma, and secondary infection produces an ulcerating, foul-smelling lesion. During the fly season, the affected eye is often infested with maggots. A tumor that is incompletely removed in the early stages will grow and spread to the adjacent bony structures and eventually reach the lymph stream.

Secondary growths in the lymph glands of the head and in the lung may soon follow. Occasionally the liver and other organs may also become involved. Animals in the advanced stage of the disease will eventually die or are likely to be condemned for human use if they are sent in for slaughter before death ensues. In cattle showing only a small, localized eye tumor at slaughter, only the head may be unfit for food purposes.

THE SPECIFIC CAUSE of cancer of the eye or eyelids, like other malignant tumors, is not known. Several theories have been expressed. One opinion is that it is an hereditary predisposition, particularly in the Hereford breed, because the disease prevails in the cattle-raising sections of the country, the Western and the Southwestern States, where the Hereford breed predominates. Perhaps certain strains are more susceptible than others. Whether this greater occurrence of cancer eye in Herefords is more apparent than real

is problematic. In slaughtering establishments where eye tumors are most commonly found, however, about 90 percent of the cattle so affected are of the Hereford breed. The majority of Herefords affected with this tumor, particularly of the eyelids, have no pigmented skin about the eye, but the disease may occasionally arise in those with pigmented skin.

The relative frequency with which cancer eye and other tumors appear in cattle was reported in 1933 after a survey of animals coming to slaughter in federally inspected abattoirs in Denver, Colo. In 3 months, 213 cattle were found with cancer eye among 32,499 slaughtered (0.65 percent); 203 (95.3 percent) were in the Hereford breed; and 10 (4.7 percent) involved other breeds. Cancer eye has been observed as well in the Holstein, Guernsey, Jersey, and the Shorthorn breeds. Cancer eye in sheep has also been reported.

THE COMMON WART (infectious papilloma) of the skin occurs in animals and is more prevalent in cattle. The condition also has been reported in goats. Calves and yearlings seem to be more susceptible than older cattle. In the younger animals, the warts usually appear on various parts of the head and on the sides of the neck and the shoulder but may spread to other parts of the body. Warts in cows customarily affect the udder and teats. Severe cases may sap the strength and stunt the growth of young cattle. More important is the damage to the hides in areas of the skin containing the warts.

After tanning, the hides so affected have rough and weak spots and frequently contain numerous pits or holes, which impart a moth-eaten appearance to the finished leather. The hide consequently is of less value.

COMMON WARTS in cattle are infectious and are caused by a virus. They have been produced experimentally in the laboratory. Infection is believed to take place under natural conditions when injured skin comes in contact with infectious material. Segregation of affected animals is recommended, followed by cleaning and disinfecting all stables, pens, chutes, and rubbing posts where they have been. Particular care should be taken in milking cows with warts on their udders and teats to prevent spread of the warts from animal to animal.

A wart vaccine is used for immunization, prevention of the disease, and treatment of affected animals. It is said that a single injection of the vaccine under the skin will result in rapid regression of the warts in most cases.

THE ADRENAL GLANDS of cattle and sheep are more apt to contain tumors than any of the other internal body organs. Adrenal tumors are usually unilateral, but both glands may be involved. They may be benign or malignant. They often grow to considerable size. The growths usually remain localized, although sometimes they spread to the lung by way of the blood stream.

The uterus of the cow is involved with malignant growth oftener than was once supposed. Observations made in the Animal Disease Research Laboratory in Denver in 1953 and 1954 indicate that cancer of the bovine uterus can no longer be considered a rare tumor. In fact, the uterus can now be classed as one of the body organs most frequently affected with malignancy. Cancer of the uterus is not easily diagnosed in the cow, however, and is probably not recognized until the animal comes to slaughter.

It seems reasonable to assume that when the uterus is involved with a malignant growth, a breeding problem, if not sterility, may result.

THE PRIMARY SITE of tumorous growth occurs occasionally in other body organs of cattle in the following relative order of frequency: Liver, gallbladder, ovary, kidney, and heart.

Lymph glands, bone, cartilage, and muscle also may be sites of tumor

formation. The most important is the malignant lymphoma arising from lymphoid tissue, particularly the lymph glands. It often is found throughout the carcass in slaughtered animals of all ages and breeds. Nearly all body organs and the tissues at one time or another have been affected with a malignant lymphoma. It is among the commonest type of malignant tumor in slaughtered cattle, sheep, and hogs for which there is total condemnation of the carcass. Many animals die of the disease before coming to slaughter.

TUMORS of the peripheral nervous system that are referred to as "Schwannomas" have their origin from certain connective tissue cells (Schwann's cell) in the enveloping membrane of nerves. A report made in 1953 of a series of 24 cases of this type of tumor in cattle coming to slaughter listed the Schwannoma as one of the more usual bovine tumors. The tumors may involve several nerves in different parts of the body simultaneously. The heart, brachial plexus, and intercostal nerves are the most common locations of the tumors. They are primarily benign, but not always so.

They are uncommon in other food-producing animals.

TUMORS IN SWINE are seen less frequently, probably because hogs are slaughtered at a comparatively early age. Aside from the occurrence of malignant lymphoma and melanotic pigmented tumors of the skin, only one other tumor need be mentioned here. That is a primary tumor of the kidney called embryonal nephroma. It is the commonest tumor of swine. It is of interest also because of its similarity to a malignant, often fatal tumor of the kidney (Wilm's tumor) that sometimes occurs in children. The tumor in swine, however, is recognized only at the time of slaughter. It may grow to considerable size, with complete destruction of the involved kidney, and may spread to other organs of the body. Both kidneys are sometimes involved at the same time.

THE ESTIMATED LOSS from tumors in slaughtered cattle, sheep, and swine was nearly 2 million dollars in 1949. At that time, only about 65 percent of all meat-producing animals were slaughtered under Federal inspection (80 percent in 1954). Assuming that the condemnations for tumors were in equal proportions among the 35 percent slaughtered in nonfederally inspected establishments, another million dollars could be added to the annual loss from tumors in slaughtered animals.

The annual loss attributable to this disease on farms and ranches would be difficult to assess. No statistics are available; there is no method of reporting them. But there is no doubt that many die each year of cancer in one form or another.

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