THE PRIMARY SITUATION OF 133 SPONTANEOUS TUMORS IN THE LOWER ANIMALS

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The predilection of certain tissues in man for tumorous involvement has long been appreciated. In the lower animals, however, the comparatively meager data concerning neoplasms in general have made it extremely difficult to draw definite conclusions as to the occurrence of tumors in the respective tissues of the various species.

It is not intended in this paper to offer anything more than a report, since the number of tumors studied was in general far too small to justify conclusions as to the relative frequency of tumors in the various tissues.

In a previous paper (3) dealing with tumors in the lower animals the incidence of the different varieties of new growths was recorded. Only brief mention was made of the tissues involved by the various growths in the respective species and as a consequence much of value to the reviewer of comparative pathology was omitted. Since this report was published (November, 1926) some of the original data were lost by fire * and are not, therefore, available for this paper. Since this loss, much new material has been collected and studied. Data from this material have been added to those which were previously reported, and it is my intention to make future reports of a similar nature as material accumulates.

The 133 tumors constituting the data for this report were distributed among the different species as follows: cattle, thirty-seven; horse, twenty-six; mule, three; swine, seventeen; sheep, three; dog, twenty-eight; fowl, seventeen; rabbit, one; mouse, one.

* Fire destroyed the building housing the Department of Veterinary Pathology, Colorado Agricultural College, the latter part of January, 1927. I was affiliated with this institution at that time.
TUMORS OF CATTLE

This group constituted a series of thirty-six true neoplasms representing twelve varieties and one growth which resembled heterotopic thyroid tissue. The thirty-seven specimens were distributed among the varieties of tumors as follows: carcinoma (epidermoid and squamous-cell) thirteen, adenocarcinoma two, fibroma two, fibrosarcoma three, leiomyoma two, hemangio-endothelioma one, simple lymphoma one, lymphocytoma (leukemia) one, lymphosarcoma three, melanoma three, papilloma one, and adrenal carcinoma five.

A review of the tissues affected by these tumors reveals some interesting facts as to tissue susceptibility for the various types of tumor. The thirteen carcinomas involved the eye or its appendages. Of the adenocarcinomas, one apparently developed from heterotopic thyroid tissue lateral to the first cervical vertebra and one had its origin in the lung. Fibroma was found once in the skin behind the ear and once at the distal extremity of the penis. Of the three fibrosarcomas one was internal, involving the vesicogenital pouch, and two were external, one occurring on the distal portion of the penis and the other on the lateral surface of the lower jaw. The two leiomyomas involved the uterine wall. The adrenal cortex gave rise to five tumors which could be classed as carcinoma. The three melanomas and the tumor designated hemangio-endothelioma arose from the skin. The one papilloma occurred on the lining of the esophagus. The lymphoid tumors, of which there were five, were distributed as follows: one, a lymphoma, probably arose from the internal iliac lymph node; the three lymphosarcomas arose, one from the os uteri, and two from the abomasum and proximal portion of the small intestine with widespread metastasis; the lymphocytoma (leukemia) had an obscure origin, and there was enlargement of most of the internal and many of the body lymph nodes with metastasis to the kidney.

Among the thirty-seven bovine tumors several were exceedingly interesting and a few have been selected for a brief description.
Adenocarcinoma in a Five-year-old Grade Cow (Tumor 44) (2). The tumor was under the skin over the muscles of the neck, lateral and just posterior to the first cervical vertebra. It was an adenomatous type of growth resembling in many details the tissue of the thyroid gland. The numerous alveolar spaces were filled with a colloid-like substance and a few of the cells revealed mitosis. This growth probably had its origin from heterotopic thyroid tissue. Adenocarcinoma was diagnosed.

Probable Lymphocytoma in a Five-year-old Shorthorn Bull (Tumor 104). All of the thoracic and many of the mesenteric lymph nodes were enlarged, as were several of the regional body lymph nodes. Those who made the necropsy considered all of the swollen lymph nodes to be the result of a neoplastic process but the only material received for study was a portion of one kidney which contained a number of grayish-white spherical areas. At necropsy generalized actinomycosis was revealed. The renal lesion represents a secondary situation of the tumor which undoubtedly indicates a disturbance of the lymphoid tissue. Probable lymphocytoma (leukemia) was diagnosed (Fig. 1).

Secondary Epidermoid Carcinoma in a Mature Grade Cow (Tumor 111).—A foul-smelling ulcerated growth involved one eye. At necropsy a

Fig. 1. (Tumor 104.) Metastatic Lymphocytoma of a Bull. Neoplastic cells occupying a. Interstitial position in the kidney are shown. (Low power.)
mass 12.5 cm. in diameter was found in one of the lungs. A growth was also found in the heart muscle. Only a portion of the pulmonary tumor was received for study. The material was found to be carcinomatous with a marked tendency toward extensive cornification with some areas of calcification. The clinical data, together with the malignant tendency of this type of neoplasm, suggest the probability that the pulmonary tumor represented a secondary invasion, metastatic from the eye. The cardiac tumor may likewise have been a carcinoma metastatic from the pulmonary lesion. Secondary epidermoid carcinoma was diagnosed.

**Fig. 2.** (Tumor 118.) Primary Adenocarcinoma of the Lung of a Steer. The duct-like arrangement of the cells of the parenchyma of the tumor is shown. (Low power.)

**Pulmonary Neoplasm in a Three-year-old Shorthorn Steer (Tumor 118).**—Necropsy showed both lungs to be extensively involved by numerous pea-sized nodules, about fifty or sixty in all; one lung contained a large mass, $5 \times 8 \times 6$ cm. Careful examination was made of the entire carcass but aside from the condition found in the lungs the only abnormality discovered was enlargement of the left bronchial lymph node, and telangiectasis of the liver. Sections from the pulmonary mass and from the bronchial node showed that the tumor was an adenocarcinoma. Unusual primary pulmonary neoplasm perhaps had originated from the mucous glands of the bronchi or trachea (Fig. 2).
The more numerous neoplasms of this series constituted the following percentages of the total: carcinoma (epidermoid and squamous-cell) 35.1 per cent, malignant lymphoblastoma 11.8 per cent, and adrenal carcinoma 13.5 per cent.

As far as is possible to draw conclusions from such a relatively small series, it is evident that carcinoma is the most frequent external tumor of cattle, affecting most frequently the eye and its appendages. In the cases studied all of the bovine carcinomas had this origin. It indeed seems unusual that 35 per cent of bovine neoplasms should occur in the eye and that the tumor peculiar to this origin or region should be in every case a carcinoma.

It would be assuming too much to conclude that carcinoma never occurs externally in cattle except in association with the eye. From the data available, however, the occurrence elsewhere must be infrequent, if not rare.

It is perhaps significant that nine of the thirteen animals harboring carcinoma of the eye should be of the Hereford breed. Among stockmen in the West the Hereford has a reputation for carcinoma of the eye, and it cannot be denied that this breed does not yield the greatest numbers of carcinoma of this organ. There is no satisfactory explanation of the high incidence of carcinoma of the eye in this breed. Prolonged irritation of the mucosa of the eye by sand and other foreign particles and the lack of pigment in the surrounding mucosa of the organ have been advanced by cattlemen as responsible for this tumor. Neither of these appear adequate in revealing the true explanation of this apparent predilection.

The penis of the male of this species would appear to favor the occurrence of fibroblastic tumors and in this respect cattle differ from the horse in that the commonest tumor of the penis of the horse is carcinoma.

The most common internal tumors of cattle are apparently the malignant lymphoblastoma and the adrenal carcinoma. The lymphosarcoma that arises in the abomasum and duodenum are capable of widespread metastasis although the opposite is true of carcinoma of the adrenal cortex.
A study of the morbid anatomy presented in the five adrenal tumors showed slowly progressive growths, often overtaken by retrogressive changes with slight tendency to infiltration. Metastasis was not demonstrable. It seems unusual that these so-called hypernephromas should all be confined to the adrenal gland, or to that region, with the kidney apparently escaping this type of neoplastic involvement insofar as cattle are concerned.

**Tumors of the Horse**

The horse was affected with twenty-six neoplasms representing eight varieties: carcinoma (all varieties) fourteen, fibrosarcoma one, fibroma three, lipoma one, melanoblastoma four, mesothelioma (malignant) one, cholesteatoma one, and myeloblastic sarcoma one.

The epithelial tumors, all malignant, arose in the eye or its appendages in seven cases, on the glans penis in three cases, from the prepuce in one case, and from the sweat glands of the concha in one case, and from the region over the right premolar teeth in one case; in one instance the original site of a tumor involving the mesentery, omentum, liver and lungs was uncertain.

The fibromas occurred in the skin in two cases and on the eyeball in one; the only fibrosarcoma encountered had its origin on the lower border of the ear.

The one lipoma occurred in the subcutaneous tissue and the cholesteatoma occupied one of the lateral ventricles of the brain. The tumor designated malignant mesothelioma, for want of a better name, seemed to have had its origin in the parietal pleura although one should not be overly positive in stating the origin of tumors of this kind.

Simple melanoma occurred in the eyelid in two cases, and malignant melanoma affected the ventral surface of the tail in one case, and the skin of the neck and the region of the anus with general distribution throughout the body in another.

From the equine specimens the following three were unusual enough to warrant a brief description:
Malignant Mesothelioma in a Ten-year-old Male (Tumor 49) (1).—A large mass was found at the anterior thoracic aperture which involved in a very intimate way the esophagus, common carotid arteries and jugular veins. Small multiple and flattened nodular formations were firmly attached to the parietal pleura of the right side. The lungs were not involved. Malignant mesothelioma was diagnosed.

Carcinoma in a Six-year-old Male (Tumor 134).—A rapidly developing tumor appeared over the right premolar teeth. It was a rather unusual type of malignant epithelial tumor in which the cells occurred in irregular spherical clumps, reminding one of an epulis except that the giant cells were not a part of the picture. The origin of the tumor from the paradental epithelial debris is suggested. While it lacks the characteristic features of an adamantinoma it must nevertheless be considered a carcinoma (Fig. 3).

Myeloblastic Sarcoma in a Male Grade Percheron More than Twenty Years of Age (Tumor 235).—The animal died of acute indigestion. The tumors were detected while the flesh of the carcass was being re-
moved for dog food. According to those who dressed the carcass, the lungs, which were not available for study, were filled with small nodules. The material presented consisted of rather massive growths fairly regular in contour and rather firmly adherent to the thoracic wall. The larger masses were near the thoracic aperture. The growths on the parietal serosa were smaller and situated in the posterior portion of the thorax, quite remote from and not connected with the tumors at the anterior end of the thorax. The pathologic histology of this tumor was difficult to interpret. The cells were myeloblastic in appearance. A study of the blood was not possible, and it would perhaps be assuming too much to call this tumor a part of a myelogenous leukemic process. Under the circumstances the designation myeloblastic sarcoma seems fitting (Fig. 4).

![Fig. 4. (Tumor 235.) Myeloblastic Sarcoma of a Horse. (X 600.)](image)

The more numerous of the equine tumors constituted the following percentages of the total: epithelioma (all varieties) 53.8 per cent, fibroblastoma 13.5 per cent, and melanoblastoma 13.3 per cent.

As was true with the bovine tumors, most of the equine neoplasms are true carcinoma. The percentage of malignant epi-
thelioma is greater in the horse than in cattle; more than half of all the equine tumors collected were in this group.

Here, as was true with the bovine carcinomas, the eye appears to be particularly susceptible; seven of the fourteen tumors of this variety affected this organ. In the male, the penis also shows a suggestive predilection for carcinoma and next to the eye it is the most frequent site for this malignant disease.

The average age of the animals with malignant epithelioma is interesting. Of the fourteen cases presented, the age was known in eleven instances as follows: one sixteen years; one fifteen years; one fourteen years; one eleven years; two ten years; two nine years; one eight years, and two six years. The average age in the eleven cases was ten and three-tenths years. It is evident that most of the epitheliomas occurred in horses that could no longer be considered young. Perhaps there is a cancer age for horses corresponding relatively to the similar period for man.

The figures presented would indicate that, contrary to the general opinion, melanotic tumors are not the common ones of the horse. On the other hand, these tumors are diagnosed readily from their gross appearance and the curiosity that might prompt the veterinarian or horse owner to seek the assistance of the pathologist in diagnosing a carcinoma is likely to be absent in the case of these strikingly pigmented tumors and as a result perhaps only a relatively small proportion of them reach the laboratory.

Lymphoid tumors which are frequently observed in certain of the other species must be rare in the horse, if the cases presented in this small series can be considered trustworthy criteria.

It would seem peculiar that internal tumors of the horse should be so infrequently encountered. Of the twenty-six tumors in this series only four occupied the large body cavities and only one involved the brain. Can it be that most of them develop externally as the result of traumatic stimuli to which the exterior of the body is more prone than the interior? Certainly instances of neoplastic proliferations following trauma are plentiful in many of the cases and there can be no doubt of the greater op-
portunity for the exposed tissues to become traumatized as compared to the better protected tissues of the interior. It must be admitted that conclusions as to the frequency of external tumors, as compared to those of internal origin, should be cautiously drawn, for not every internal neoplasm gives rise to sufficient symptoms to enable one to make a diagnosis while the animal is alive, and certainly all horses that die or are destroyed do not come to necropsy.

External tumors are usually clearly evident to the casual observer, and as a consequence perhaps more of them reach the pathologist than is the case in those which are dependent on necropsy for their discovery.

TUMORS OF THE MULE

Two of the three tumors were fibromas and one was a fibrosarcoma. One of the fibromas arose in the skin of the pectoral region and the other was multiple in the skin of the forearm, at the point of the shoulder, above the right eye, around the anus and at the base of the tail. The fibrosarcoma appeared in the region slightly above the outer canthus of the eye.

The three cases of tumor in the mule represented only one type of cell, the fibroblast. Only one of the growths was malignant from the standpoint of its pathologic histology; the others were histologically benign, although one was characterized by multiple manifestation of the growths which were distributed widely over the body.

From the small number of tumors in the mule which have been collected one is not justified in drawing any conclusions whatever as to the incidence of spontaneous tumor in this animal. Neither can anything be said as to the varieties of tumor to which the mule is most susceptible, nor where different tumors are most likely to occur.

I cannot believe that the mule is notably less susceptible to neoplastic proliferations than the closely related horse. The meagerness of the data collected on this animal is due no doubt to the relatively few mules in the area from which I have collected most of the equine tumors. Accurate and conclusive informa-
tion on this point can only be assembled by one who makes his observations and collects his material in a part of the country where the mule is present in such numbers as to render such work comprehensive.

TUMORS OF SWINE

From this species only seventeen specimens were studied. Most of the tumors were from animals which had been slaughtered for food, and the discovery of a neoplasm was accidental during the routine postmortem examination conducted by federal veterinarians to determine the wholesomeness of the carcass for human consumption.

The seventeen tumors of the swine were distributed among the following varieties: lymphosarcoma one, melanosarcoma four, medullary carcinoma one, hypernephroma one, embryonal nephroma ten.

The only malignant lymphoblastic tumor encountered had its origin in the sublumbar region and, while exact information is lacking, it is probable that the growth had its primary inception in the lymph tissue of this region. The lumbar and iliac nodes offer possibilities as points of origin.

The melanotic tumors, all of which were malignant, had their origin in the skin, two from the region of the flank, one posterior to the scapula and one from the abdominal wall near the umbilicus.

The mammary gland apparently gave rise to one tumor, a medullary carcinoma. In this instance the exact point of origin was not included with the clinical data and the mammary gland is suggested as the probable source because of the histologic character of the type cell and its relation to the surrounding stroma.

As a source of tumorous proliferation the kidney of swine is indeed a fruitful one. In this series of seventeen tumors, nine (53 per cent) arose in this organ while two others arose posterior to the kidney, perhaps from certain portions of the mesonephros or primitive kidney which were not involved in the development of the permanent organ.
One of the nine tumors which involved the kidney directly was quite unusual for this species, a true hypernephroma. A brief report of the case follows.

Hypernephroma in a Six-month-old Male (Tumor 232).—An area 2.5 cm. in diameter at one end of the left kidney appeared to be abscessed and on incision it was found to contain thick pus. The outer covering was thickened and flesh-like in appearance. Sections from the abscessed portions showed a peculiar mixed type of cellular struc-

![Image](https://via.placeholder.com/150)

ture suspiciously like an embryonal tumor of the kidney heavily covered with old granulation tissue. The type cell was the large clear one laid down in narrow sheets without lumen formation. The deeper portion of the material showed the same type of cell which had been overtaken by a retrogressive change with consequent necrosis. There was much fibrous replacement throughout (Fig. 5).

True hypernephromas are not common in the lower animals. In this instance there can be but little doubt as to the neoplasm in question being a true Grawitz tumor and not a renal carcinoma, the tumor being composed of narrow sheets of large clear cells without any suggestion of lumen formation such as characterizes true renal carcinoma.
By far the most common neoplasm of the hog is the embryonal nephroma which usually arises in the substance of the kidney (Fig. 6). These tumors may be either pure carcinomas or composed of epithelial and connective-tissue elements, both of which exhibit true neoplastic tendencies. Those of the latter type are best termed embryonal adenosarcoma, while those of the former type may be designated embryonal adenocarcinoma.

The tumors which have been listed bear out the common conception that aside from those tumors which arise as the result of congenital anomaly the hog enjoys considerable immunity to new growths. Certainly this animal is not as susceptible to tumors as the horse and cattle and perhaps less so than the dog or the common domestic fowl. The fact that most swine are slaughtered at a comparatively early age may account for the relative paucity of tumors encountered in this species. The high percentage of embryonal tumors encountered among the relatively small total may also be explained in the same way. In other words, if most hogs were permitted to attain what for a hog would be considered middle age or old age, other tumors in sufficient numbers might appear, and as a consequence the high percentage of embryonal growths would be diminished.

Aside from the embryonal proliferations of the kidney, internal tumors of the hog at the age at which the majority come
to necropsy are rare. Correspondingly rare are the external tumors. Of the seventeen specimens constituting the total in this report five (about 20.9 per cent) occurred on or near the surface of the body. Four of these were melanotic in nature and had their inception in the skin. The other tumor which was considered external in origin perhaps arose in the mammary tissue although this supposition was not positively established.

Considering the frequency of melanosis in the skin of swine it is perhaps not surprising that proliferative pigmented nodules occasionally appear. It cannot be determined, however, whether pigmented tumors arise from a flattened melanotic area in the skin. In fact the great majority of hog carcasses whose skin presents areas of melanotic pigment are free from nodules without which the condition must be considered simple melanosis and not a melanotic tumor. Even in those cases where multiple malignant melanotic tumors are found, flattened pigmented areas are usually absent.

The exact relationship between simple melanosis and melanotic tumors in the hog has not been satisfactorily determined. However, the two conditions are readily differentiated clinically.

The relative freedom of swine from the ordinary carcinomatous proliferations, both internal and external, is suggested even from the small number of tumors examined from this species. In general it may be said that most tumors in the hog are those of congenital inception or of an embryonic character.

**TUMORS OF SHEEP**

From this species only three specimens were received, all of which were of sufficient interest to warrant a brief description.

*Lymphosarcoma in an Eighteen-month-old Shropshire Ewe (Tumor 81).*—The animal had been slaughtered for food. Firm nodular swellings were found bilaterally at the base of the scapulas. It was observed that the prescapular lymph nodes were enlarged and slightly congested. Unfortunately these nodes were not available for histologic examination. The tumors were practically identical, each being somewhat hemispheric in shape, and measuring about 20 by 20 cm. in their greatest dimensions. They were firm in consistence and of a circumscribed nature. Lymphosarcoma was diagnosed (Fig. 7).
Lymphosarcoma in a Two-year-old Male Southdown (Tumor 113).—The animal had been in apparent health up to within a few days of death. Necropsy revealed a large tumor imbedded in the spleen. Throughout the lungs and liver there were numerous smaller nodules. Multiple metastatic lymphosarcoma was diagnosed.

Carcinoma in a Three-year-old Ewe (Tumor 208).—The breed was not stated. The right adrenal body was the site of a tumor which measured 4.5 by 3.5 cm. Carcinoma of the adrenal gland was diagnosed.

The few tumors examined from the sheep hardly justify any discussion on this particular phase of the contribution. In a series of 132 tumors of animals reported in another paper only two were in sheep. This in spite of the fact that the collection of these tumors was made with the cooperation of meat inspectors in several large packing establishments, where large numbers of sheep are slaughtered annually. Two of the three sheep tumors reported were cases from packing houses and the third, tumor 113, was from an animal belonging to a farm flock.

The scarcity of sheep tumors in the literature also attests to the infrequency of neoplasms in this species. As is true with the hog, the sheep in the United States is raised primarily for food. Most of the animals are slaughtered while comparatively young so that other than congenital tumors are denied the opportunity
of appearing as they might do if most of the sheep population was permitted to reach an age comparable with that of the dog, the horse or cattle.

For several years I lived in a part of the West where several hundred thousand lambs are fed annually. Losses in the feed lots from acute infectious diseases and dietary disturbances are often extremely heavy, averaging perhaps from 3 to 5 per cent. A goodly number of those that die come to necropsy, and in the thousands of such examinations made by the Department of Veterinary Pathology of the Colorado Agricultural College not a single neoplasm has ever been encountered. This substantiates the experience of federal meat inspectors. Reports from those in charge of the federal meat inspection service in several of the larger packing centers concur in the opinion that tumors in sheep are comparatively rare and particularly so in the younger or lamb class. A considerable number of old ewes and wethers are slaughtered yearly and the scarcity of neoplasms from these older sheep, together with the other points discussed, at least indicates that this species possesses a considerable racial insusceptibility to new growths.

TUMORS OF THE DOG

The twenty-eight new growths from the dog were distributed among the various kinds of tumors as follows: fibrosarcoma one, myxosarcoma one, lipoma one, endothelioma one, lymphocytoma one, lymphosarcoma eight, carcinoma four, adenocarcinoma two, adenoma four, papilloma one, melanomasarcoma one, leiomyoma one, and teratoma one; and there was one tumor of uncertain histogenesis. The fibrosarcoma arose in the skin. The myxosarcoma appeared to have arisen in the tissues of the mediastinum. The lipoma had a subcutaneous origin in the tissues over the hip-joint. The tumor designated endothelioma had its primary inception in the subcutis of the thoracic wall and metastasized to the lungs. The case of lymphocytoma revealed generalized involvement of the lymph nodes. The nodes in widely separated situations showed the disease with equal severity. The lymphosarcomas arose in the mucosa of the vagina in two cases and from the skin or subcutis in six cases. The carcinomas arose in one case from
the skin of the toe and foot pad, in one case in the testicle, an embryonal type, in one case from the mucosa of the pharynx, and in one case from the skin over the sternum. The adenocarcinomas, of which there were two, originated in the thyroid gland and metastasized to the lungs. The tissues of the inner canthus of the eye yielded two of the four adenomas; one of the remaining two arose from the sebaceous glands of the ear and the other involved the mammary tissue. The one papilloma grew from the mucosa of the lip, and the leiomyoma developed from the musculature of the cecum. The melanomas rose in the mammary tissue and there was metastasis to the meninges of the cord. Two of the tumors were unusual enough to warrant brief description:

Fig. 8. (Tumor 202.) Malignant Teratoma from a Dog. Fibroblastic cells adjacent to an area of cartilage are shown. (High power.)

*Teratoma in an Old Female Chesapeake (Tumor 202).*—The animal was emaciated, and the abdomen was greatly enlarged. An enormous mass weighing 20.5 pounds (8.3 + kg.) occupied the position where the ovary is usually found and there was additional attachment by the broad ligament. Malignant teratoma was diagnosed. (Fig. 8).
Tumor of Uncertain Histogenesis in an Adult Mongrel (Tumor 228).—There were large, multiple, flattened, fleshy growths involving the parietal pleura with small foci throughout both lungs. There were also smaller nodules on the thoracic surface of the diaphragmatic pleura. The exact nature of this process could not be definitely determined. By some it might be classed as an endothelioma, by others as a mesothelioma. Some would no doubt designate it by the rather unsatisfactory term, sarcoma. Certainly it was not epithelial in nature. The parietal pleura was concerned in the neoplastic process in such an intimate way as to tempt one to designate the tumor mesothelioma or endothelioma regardless of the opposition of some to the use of these terms for growths of the thoracic serosa. This particular growth exhibited considerable aggressiveness as evidenced by the widespread distribution of minute neoplastic foci throughout both lungs.

A review of the tumors derived from the dog would indicate that this animal is susceptible to practically all of the more common neoplastic diseases; the dog is probably capable of giving rise to a larger variety of tumors than most of the other species. While the total number of cases studied is too small to justify anything but general conclusions, it is evident that the lymphoid tumors constitute a considerable percentage of canine neoplasms. In this series nine (about 32 per cent) were in this general group. Only one of these can properly be referred to as involving primarily the lymph nodes.

I have included with the lymphosarcomas those clinically peculiar tumors which occasionally arise in the vagina of the bitch, and on the penis of the male, and which are probably transmitted by coitus. While the exact histogenesis of the tumors has perhaps not been definitely agreed on, most of those who have made any considerable study of the disease have concluded that it represents a true tumorous process and that histologically at least it should be considered a lymphosarcoma (Fig. 9).

The eight tumors designated as lymphosarcoma constitute a group of neoplastic processes with an extremely interesting histogenesis. While histologically there can be no question as to the propriety of applying the term lymphosarcoma to these
growths and while they exhibited a clinical behavior comparable to the usual lymphosarcomatosis, they arose in tissues other than lymph nodes.

Aside from the two vaginal tumors of this variety, six of the lymphosarcomas arose in situations quite devoid of demonstrable lymph tissue yet with definite and menacing metastasis to the regional lymph nodes which occurred in most instances.

In many of these cases the tumor followed definite trauma which was usually mild in type and continued over a variable period. The histories of these cases reveal instances in which the tumor arose in the area irritated by an ill-fitting collar, or from that part of the body traumatized by a screen door which the dog opened by pushing his way between the screen door and the door frame. In two instances the situations yielding the new growths had been traumatized by contact with the wire grating of the cage floor. Both of these animals were confined to cages for more than three years with only a short period of daily exercise to break the continuity of cage life. In both of these the tumor developed in the regions that were in direct contact with the floor grating when the dogs were in the recumbent position. During the same period that these two animals developed lymphosarcoma, three other dogs who had also spent
several years in kennel cages developed typical traumatic granulomas or keloids in the skin over the anterior portion of the sternum.

These cases further emphasize the possibility of new tissue proliferations arising as a result of overstimulation of the protective and reparative elements of the body as a consequence of an injury.

The relatively few tumors studied in this series would indicate that the carcinomas do not occur in the dog with the same frequency as the same tumors in the bovine and equine species. Of the twenty-eight tumors collected from the dog only four (14 per cent) were carcinomas and of these one, the embryonal carcinoma of the testicle, was undoubtedly of congenital origin.

Most of the tissues of the dog appear to exhibit an apparent resistance to carcinomatous changes and as a consequence this type of tumor is somewhat uncommonly observed.

The adenocarcinomas which I have considered separately
from the carcinomas, appeared only twice and in both instances they were primarily in the thyroid gland with characteristic metastasis to the lungs. This seems to be one neoplastic disease which has a rather definite manifestation both grossly and histologically, at least in the dog (Fig. 10).

Adenomas are not uncommonly encountered and arise most frequently perhaps from the superficial palpebral gland at the inner canthus of the eye.

Of some interest is the tumor listed as a melanosarcoma. Only the metastatic portion of the tumor which involved the meninges of the cord was obtainable. The primary tumor was described as occurring in the mammary gland which is indeed an unusual site for a tumor of this character. The meningeal portion of the tumor consisted of a dense fibrous stroma with the young melanoblasts arranged in thin columns with an occasional nest-like formation showing all stages of mitotic division. The involvement of the dura mater is as unusual as is the site of the primary growth and points to generalization of the disease by way of the blood stream.

The failure to classify satisfactorily tumor 228, which involved the pleura and the lungs so extensively, emphasizes anew how inadequate is our knowledge of tumors of this kind. Present information unfortunately does not permit the identification of the histogenesis of every tumor by a cytologic study alone, and so, perhaps often unconsciously, reliance for assistance is placed on the tissue most markedly involved in the disease process. So here it is difficult to resist the temptation to suggest that this growth may have arisen from the mesothelial cells lining the pleural cavity. If this be true it is at least debatable whether the tumor should be considered carcinoma, endothelioma, mesothelioma, or, as some would prefer, sarcoma. It is beyond the sphere of this paper to enter into the controversial aspects of such a question. Suffice it to say that the tumor, clinically at least, strongly suggested that its primary inception was from the surface cells of the pleura.

The teratoma encountered was probably a rare observation, as was perhaps the leiomyoma.
From the common fowl seventeen cases of neoplastic disease were obtained. The material fell into six varieties of tumor as follows: leiomyoma one, lymphocytoma seven, lymphosarcoma three, cystadenoma one, adenocarcinoma four, and carcinoma one.

The musculature of the oviduct gave rise to the one leiomyoma and two of the adenocarcinomas arose from the mucosa of this structure. The other two adenocarcinomas seemed to have had their origin from the intestinal mucosa. The disease in both instances was so extensive and so far advanced as to make it extremely difficult if not impossible to determine with accuracy the exact point from which the tumor developed (Fig. 11). The ovary was markedly affected in one of the intestinal adenocarcinomas while in the other intestinal form of this tumor the liver and spleen were secondarily involved to a slight degree. The mucosa of the pharynx was the site of origin of the only carcinoma encountered.
The lymphosarcomas arose once from the cervical lymph node, once from the omentum, and once from the wall of the gizzard. The lymphocytomas, of which there were seven, affected the liver in six of the cases in which necropsy was complete. In the remaining case the tissues of the head were extensively involved in what was perhaps a metastatic manifestation from a primary focus elsewhere. In this case, while it is reasonable to assume that the liver was affected, the abdomen was not opened and consequently involvement of the liver, as well as the involvement of other abdominal tissues, must remain a matter of conjecture. The lymphocytomas affected the kidney, spleen, and liver in two cases; the spleen and liver were affected, in one instance; in only one case was the kidney alone affected as well as the liver, and in one case the demonstrable lesions were confined to the liver alone.

The term lymphocytoma has been used in this paper to designate the lymphoid disease of chickens, ordinarily spoken of as leukemia. Some, including Warthin, have pointed out that the disease may be either leukemic or aleukemic in type but, since there was no opportunity to study the blood in smears from the living bird in any of the cases reported in this paper, no attempt is made to separate them on the basis of the histologic criteria. While this might be accomplished in certain instances it must be looked on as a procedure of questionable accuracy.

Considering the large chicken population in comparison to the other species, one would perhaps be justified in anticipating a greater number of avian neoplasms than the seventeen presented here. The reason that relatively few avian tumors find their way to the pathologist is probably that the great majority of fowls are killed and dressed for the market, and the task of removing the viscera usually falls to those without any knowledge of disease, and thus it is rare that a tumor encountered during the dressing procedure is sent to the laboratory. Those that are received from this source are practically always brought or sent by a housewife who out of curiosity desires to know the nature of the condition encountered.

There can be no question but that tumors constitute a factor
of considerable importance in accounting for the loss by disability and death, especially in large flocks. Schneider, in a comprehensive study of material obtained from necropsies of all birds that died in a population of 11,000 birds found that the annual death rate from tumor for fowls between the ages of six and eighteen months was between 2 and 3 per cent. If it were possible to include the birds affected with tumors that do not cause evident symptoms or death and are only discovered while the carcass is being prepared for food, the percentage would unquestionably be raised.

From the meager data at hand a few facts relative to the frequency of certain varieties of avian tumor are evident. The most striking of these is the fact that the lymphocytomas constitute by far the most common neoplastic disease of the common fowl. Whether this is a communicable disease transmitted by contact or by a virus eliminated with the excreta or a spontaneous disease comparable in its origin to our conception of most malignant neoplasms, opens an interesting field for the research worker. The disease certainly exhibits every characteristic of a true tumor insofar as its histopathology and clinical course are concerned, although it must be admitted that its pathology has not been completely explained.

The two adenocarcinomas of the intestinal tract demonstrated the extent to which neoplastic disease may involve vital tissues in the fowl before clinical evidence of the disease is revealed. Although the abdominal contents of both of these birds were involved in the proliferations in an extreme manner, the general nutrition of the animals did not appear to suffer. The physical condition of one of the birds was considered by the owner as excellent yet most of the intestinal tract was heavily enshrouded by masses of new tissue which in many places were bridged across adjacent portions of the gut. The hen also had a large ovarian tumor, 9 em. in diameter, an adenocarcinoma. The weight of this mass gave the bird what the owner said was a "broken down" appearance and because of this and "excessive adiposity" it was killed for the table but the necropsy data of course precluded its use as food. In the other case, the bird was killed for food be-
cause she had ceased to be an egg-producer. Perhaps the fact that these growths seemed to be confined to the outer portions of the intestine without encroaching on the lumen accounts for the failure of the disease to disturb the general physical maintenance. The physical condition of both birds was such at the time they were killed as to make it difficult to imagine an early death from the effects of the tumor.

The observation of the three lymphosarcomas is at least unusual for this species. The appearance of this type of tumor in most of the species considered in this paper suggests the likelihood of its occurrence in all species.

The one simple carcinoma recorded is, to say the least, an unusual observation in this species. Its situation in the mucosa of the pharynx is also unusual since neoplasms are seldom seen in this region. The only similar case in this series of 133 tumors was the epidermoid carcinoma which occupied a position in the posterior lateral aspect of the pharynx in a dog.

Compared to its frequency in many of the mammals, carcinoma, aside from the adenomatous variety, must be considered uncommon in the common fowl. While the common fowl is perhaps not as productive of as large a variety of neoplasms as many of the other species, it must be regarded as fairly prolific for new tissue formation, a considerable percentage of which is possessed of malignant possibilities.

MISCELLANEOUS TUMORS

Metastatic Lymphosarcoma in Rabbit (Tumor 35).—The animal had been used for immunization experiments and died suddenly. At necropsy a large elongated tumor intimately associated with the omentum was observed. The lungs also contained tumorous areas varying in size from 0.2 to 1 cm. in diameter. The abdominal tumor was not available for study since material from the lung only was received. Metastatic lymphosarcoma was diagnosed.

Malignant Tumor in an Adult Female Mouse (Tumor 133).—The animal, a large white adult, had been used for experimental purposes. There was an irregularly nodular growth 2 by 1.5 cm. on the centro-lateral portion of the hip just posterior to and slightly above the flank. The growth was covered with hair and was firmly adherent to the
underlying tissues. The tumor proved to be highly vascular and considerable hemorrhage resulted when the mass was incised. The mouse was killed and necropsy was carried out; no signs of metastasis were seen either externally or internally.

The highly vascular composition of this tumor and the arrangement of the parenchyma suggested a diagnosis of malignant endothelioma. Wells, of the University of Chicago, examined a detailed description of the tumor together with photomicrographs and believed that the growth was a common type of mammary-gland carcinoma. He stated: “In the early days of research work with mouse carcinoma several pathologists interpreted these growths as endotheliomas, but further study of their evolution showed that they arose in mammary gland tissue.”

**SUMMARY**

The primary situation of 133 spontaneous tumors in nine species is recorded. The total number of tumors studied is too small to justify more than general conclusions as to the predilection of the various tissues for new growths.

In this series the eye of cattle and horses appears to show the greatest predilection for carcinoma. In the horse the penis is, next to the eye, the most common site for carcinoma. The average age of eleven horses with carcinoma was ten and three-tenths years. Since a horse aged ten years can no longer be considered young, perhaps there is a cancer period for the horse corresponding relatively to the similar period for man. The penis of cattle appears to favor the occurrence of fibroblastic tumors. The adrenal gland of cattle gives rise to a large percentage of the internal neoplasms. Internal carcinoma is of rare occurrence in most of the species except the fowl. Lymphoid tumors are uncommon in the horse.

The most common tumor in the hog is embryonal tumor of the kidney. Melanosarcoma of the skin is perhaps the most frequent external neoplasm of swine. External carcinoma of the hog is rare. Spontaneous tumors of sheep are uncommon.

Lymphosarcoma of the skin is one of the most common tumors of the dog. The dog seems to be susceptible to practically all of
the more common neoplastic diseases. In this report the dog yielded a greater variety of tumors than any of the other species. Most of the tissues of the dog seem to possess considerable immunity to carcinoma, which is only rarely observed in the dog.

The lymphoid tumors referred to as lymphocytoma are the most common tumors of the common fowl, the liver, spleen and kidney being most often affected. External carcinoma of the fowl is uncommonly observed. Tumor in the case of a rabbit and one in the case of a mouse are recorded.

REFERENCES