ERRATUM

In Volume XVIII, Number 6, December, 1913, page 662; line 23 and following should read: Finally, artificial attenuation of the agent causing Chicken Tumor I, by heating, or/glycerination, or storage after drying, has never so altered it that it will produce tumors resembling Chicken Tumor XVIII. The agents causing the two growths may nevertheless have some relationship to each other.
THE CHARACTERS OF A THIRD TRANSPLANTABLE
CHICKEN TUMOR DUE TO A FILTERABLE CAUSE.
A SARCOMA OF INTRACANALICULAR
PATTERN.*

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PLATES 49 TO 55.

That tumors of the fowl are far from rare is now recognized; and there exists a considerable literature concerning them.¹ Efforts to transplant the growths have met in general with poor success. Thus far only three transplantable chicken tumors have been described. Three others are at present under propagation in our laboratory, one of which forms the subject of the present paper. This tumor owes its transplantation to the use of many fowls as hosts. Probably the failure to transfer chicken tumors has often been due to neglect of the point. If only two or three animals were used in each attempt to transfer spontaneous mouse tumors the results would certainly be unsatisfactory.²

The three fowl tumors previously described are a spindle-celled sarcoma,³ a myxosarcoma,⁴ and an osteochondrosarcoma.⁵ The first and last of these growths have been reported upon in detail.

* Received for publication, July 3, 1913.
¹ Ehrenreich and Michaelis, Tyzzer, Rous, Murphy, Wernicke, Tytler.
² Some tumors of the fowl, like some tumors of the mouse, resist all attempts at transplantation. The epitheliomata of the scaly portion of the leg are among these. During the past two years five such spontaneous epitheliomata have been brought to the laboratory; and more than one hundred young adult chickens have been inoculated from them, often in several ways, but without success.
Chicken Tumor Due to Filterable Cause.

They have interest not only as characteristic neoplasms in the bird, but because the cause of each has been found in an agent separable from the tumor tissue by filtration through a Berkefeld filter. The growth now to be described is quite as characteristically a neoplasm and also has a filterable cause. The experiments upon its etiology will be published in a separate paper. It is a connective tissue tumor, a sarcoma split and fissured by many compressed blood sinuses into which it tends to extend and grow in an intracanalicular pattern. Its like has not been found among the forty-three spontaneous chicken tumors recently studied by us.

THE ORIGINAL GROWTH.

The fowl with the spontaneous tumor was brought to us because of swellings in the left leg that rendered it lame. The swellings proved to be two smooth and very firm masses, lying in the muscle above and below the knee joint. They seemed attached to the bone and limited the movement at the joint in both directions. The fowl, a mongrel, brown Leghorn hen, was sparsely nourished; it died under chloroform during an exploratory operation. Inoculation of portions of the tumors were made within three hours into ten Leghorn chickens.

**Gross Findings.**—In the gizzard was a mass which may with good reason be regarded as the primary growth. It occupied nearly the whole right anterior portion of the organ, and projected irregularly under a covering of mesentery (figure 1) in which lay several small nodules up to 0.6 cm. in diameter, some sessile on the gizzard, some free. On section the mass proved roughly spherical, measuring 4.3 by 4.3 cm. (figure 2). It was everywhere surrounded by muscle and though it encroached on the gizzard cavity the mucous membrane was not eroded. It had no capsule but was sharply demarcated by its color, a pale, pinkish white, from the wine-colored muscle. It bulged on the cut surface and was made up of many irregular, tightly compressed subdivisions separated by minute, irregular fissures. Toward one side was a localized soft, yellow necrosis, but the growth was in general translucent and, though poorly vascularized, appeared sound. In the fold of mesentery extending from the gizzard to the left lobe of the liver was a flattened grayish pink nodule measuring 0.2 by 0.05 cm.

The liver was enlarged, congested, mottled with ill defined, pale areas. On its anterior surface were two small, stellate depressions marking irregular, gray areas in the parenchyma that suggested scars. These areas were later found to consist of tumor tissue. The other viscera appeared normal.

In the substance of the extensor muscles of the left thigh was an oblong, smooth mass 4.5 by 3 by 3 cm. with its long diameter in the direction of the muscle. A similar mass 4 by 3 by 3 cm. occupied the muscles just below the knee (figure 3). The upper mass was firmly attached to the periosteum for

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about 2 cm. above the patella, and to the joint capsule also. A prolongation extended from it around to the back of the joint. The lower mass was attached to the joint capsule but the bulk of it lay in the muscle. The growths were extremely firm, much firmer than the one in the gizzard, pinkish white, nearly bloodless, and consisted of finely striated tissue, in part solid and in part, like the tumor of the gizzard, divided by fissures into irregular lobuli. Some of the lobuli had a central, semigelatinous depression, and in a few the center was yellow, firm, and opaque,—evidently necrotic. The growths were unencapsulated and poorly defined from the muscle sheaths, periosteum, and tendons which they involved.

The knee joint was full of papillary proliferations (figure 3), translucent and gristly, attached to the capsule, or joint surface. The largest one had its base on the posterior surface of the patella. Microscopically all were found to be extensions from the growths on the outer surface of the capsule. Within the lower end of the femur, lying in the red marrow, was a translucent tumor mass about 0.4 cm. in diameter. The bone from without had seemed normal.

In the muscle of the chest wall just anterior to the junction of the sternal and vertebral portions of the three upper right ribs was a tumor measuring 2.5 by 1.4 by 1 cm., which projected into the thoracic cavity (figure 1). In the anterior muscles of the neck, just above the left clavicle, was a similar mass, 3.9 by 1.7 by 1.5 cm. in size; and yet a third, measuring 3 by 2 by 1 cm., lay in the muscle of the inner surface of the pelvis near the right anterior portion of its rim. All resembled the growths in the leg.

Microscopic Findings.—The tumor of the gizzard consists of a spindle-celled tissue irregularly split and separated into islands by many fairly wide channels now quite empty except for a few blood cells (figure 4). The channels are walled by only a single layer of endothelium and some of the smaller ones lack even this and are probably artefacts due to shrinkage in the fixing fluid. The prominence of the larger channels is doubtless dependent to some extent on the same cause, since they are nearly empty and the tumor in the gross was practically bloodless.

Mitoses are fairly frequent. The tumor's enlargement has obviously taken place by intrinsic proliferation coupled with the direct invasion and replacement of normal structures. In the muscle just beyond the growth's border, and not yet attacked, are numerous dilated blood spaces and capillaries. Within the tumor the sinuses thus formed have become more extensive but are filled for the most part with papilliferous extensions of tumor tissue covered everywhere by endothelium. Many of the sinuses are compressed to mere slits.

The metastases in the muscles (figure 5) closely resemble in the main the growth in the gizzard. In some parts, however, sinuses are infrequent and the tissue is practically solid.

Briefly, the curious tumor,—called in this laboratory Chicken Tumor XVIII,—consists of a spindle-celled, sarcomatous tissue fissured and subdivided by many flattened sinuses, and often intra-canaliculic in its growth (figures 4 and 5). The primary mass, as
the later findings have shown, lay in the wall of the gizzard (figures 1 and 2). Secondary growths were present at several points in the skeletal muscles, notably in the left leg where were two large masses, one of which had extended into the knee joint and the marrow of the femur (figure 3).

**TRANSPLANTATIONS.**

Transplantations of the tumor were made three hours after the host's death, by the insertion through a trocar of small bits of the fresh tissue deep in the pectoral muscle of normal fowls. The tissue used was taken from one of the growths in the left leg. The fowls were young brown Leghorns, chosen for their similarity to the original fowl, since previous observations had shown that the success of transplantation sometimes depends on the use of chickens of the same strain as the original. The fowls received two implantations, one in each breast.

Growths developed in only two of the chickens and in one of these eventually retrogressed. The nodules became palpable within a month, but their enlargement was extremely slow. That they were the expression of a general susceptibility is shown by their development at both sites of inoculation. Material for the second tumor generation was obtained by removing, forty-six days after inoculation, the tumor largest at this time. A recurrence promptly took place at the site of operation but its growth was slow. Both fowls were alive and active eight months after inoculation, one with growths still retrogressing from a maximum diameter of two centimeters, the other with masses that had gradually increased to five centimeters across. Both were now inoculated in the leg muscles with another and more malignant chicken tumor (Chicken Tumor I, a spindle-celled sarcoma) and of this they eventually died, though not till one had rounded out nearly a year as tumor host.

Chicken Tumor XVIII is now in its eighth tumor generation. It has been pushed thus far in fifteen months by transplanting from the sarcomatous nodules shortly after their appearance. With repeated transfer the percentage of successful inoculations and the rate of growth have increased markedly (text-figure 1). In the earlier generations care was taken to select hosts of brown Leghorn

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strains. Though the percentage of takes increased, the growth of the tumor was still slow when, for the third generation, series C, five brown Leghorn and six Plymouth Rock fowls were inoculated. In two hosts of each sort tumors developed, and in one Plymouth Rock they grew with unexampled rapidity. Retransplantation to other

\[\text{TEXT-FIC. I. Results of the transplantation of Chicken Tumor XVIII into seven consecutive series of fowls. The percentage of successful inoculations has been much increased, and seems little influenced by the variety of the host.}\]

Plymouth Rock fowls resulted in a still further increase in rapidity of growth and some changes in structure of the tumor and distribution of metastases. In the absence of direct comparative tests it cannot be said that the findings in Plymouth Rocks represent a special susceptibility of these fowls, because similar results might have followed a fortunate transplantation in brown Leghorns. But the facts show that Chicken Tumor XVIII, like Chicken Tumor VII (an osteochondrosarcoma), and unlike Chicken Tumor I (a spindle-celled sarcoma) in its earlier generations, can be readily transplanted to fowls of another variety than that in which it occurred spontaneously.

\textbf{Behavior of the Transplanted Tumors.}

The usual history of one of the tumors of the early generations in Leghorn fowls is as follows:

Two or three weeks after the implantation a small, firm nodule
Chickens Tumor Due to Filterable Cause.

appears where the needle has been thrust deep in the breast. This slowly enlarges with its long axis in the direction taken by the muscle fibers. On section it consists of an extremely firm, bulging, finely striated, grayish pink tissue, nearly bloodless, and in part finely subdivided by minute fissures. Small areas of necrosis or hemorrhage may be present. There is no capsule. Enlargement of the nodule takes place so slowly that only after from four to seven months does it attain a diameter of five centimeters. It is still extremely firm and somewhat elastic, on palpation suggesting cartilage, and is sound practically throughout. The host though still active emaciates as the mass becomes large and the wasting of the pectorals throws the tumor into relief. Its surface is smooth and it is irregularly football-shaped or shaped like a flattened sphere. The cut surface may be finely fissured, but there is little indication of the elaborate, intracanalicular arrangement visible macroscopically. Rarely the skin over the tumor becomes attached, or the growth fixes itself to the sternum. In resistant hosts the mass is encapsulated and may show a gross lobulation.

When the tumor has become large, secondary growths appear in the limbs of some hosts. The fowl limps and its wings seem stiff. On examination hard, elastic masses are found lying as a rule in the muscle above or below the knee joint anterior to the bone, and near the first joint of the wing on its under surface. They sometimes occur in the muscles of the neck, and in the intercostals, and about the hip. There are often several but never many of the secondary growths in one fowl, and each seems to arise by enlargement from a solitary focus. They start near a joint as a rule, sometimes from the outer surface of its capsule, and extend along and within the muscles and tendons as discrete, smooth, firm masses of much larger bulk than the normal tissues which they replace. They hinder movement greatly, and by binding the muscles to the periosteum may practically prevent it. The points at which they appear in the wing and leg are those much exposed to trauma.

The fowl in which secondary growths have developed presents a truly remarkable picture (figure 6). The wings, held close, in nearly the normal position, are not paralyzed but are stiffened,
sometimes to immovability, by firm masses lying in the muscle substance. The legs are greatly swollen about the knee and are nearly immovable at this joint. To either side of the sternum are the large, projecting, primary growths. With all this the fowl may be vigorous; and the growths give it a factitious plumpness. But sooner or later it goes into coma and a day or two later dies.

The viscera are usually free from metastases. A few small nodules may be present in the lungs. In one instance they were found in the heart. In a fowl of the second tumor generation, dying between five and six months after inoculation, there were, in addition to metastases in the wings and legs, several localizations in the skin of the body, appearing as plateau-like placques, or thickenings, raised three or four millimeters above the surface. These placques were roughly oval, circumscribed, and consisted of tumor tissue growing in the loose, superficial layer of the corium and limited by its dense, sheet-like, deep layer. The epidermis over them was not ulcerated or discolored, but the pitting of the feather follicles was much exaggerated. The viscera in this case were free of tumor.

At every autopsy the gizzard has been carefully examined. Secondary growths have not been found in it. That the tumor in the gizzard of the original fowl was primary and those in the muscles metastases seems certain.

In the Plymouth Rock fowls of the fourth to eighth tumor generations the tumor sometimes grew so rapidly as to measure five centimeters across one month after the inoculation, shortly occupying the entire breast. It has retained its firm, dense character, but no longer gives metastases to the limbs. Metastases have been found several times in the lungs, less often in the heart and liver, and once in the omentum; but in general secondary growths are rare. Those in the lungs may coalesce to render the organ semisolid.

HISTOLOGY.

In the earlier generations (brown Leghorn fowls) the tumor retained the structure of the spontaneous growth. The fissuring was often very marked and intracanalicular extension not infrequent (figure 7). Both features were found in primary and metastatic
growths, situated in the voluntary muscles; but in growths of the lungs, heart, and skin they were absent, and the tissue was that of a pure, spindle-celled sarcoma (figure 8). The structure of the organ involved, and the peculiar fashion of the growth's invasion, as interacting factors, are doubtless responsible for this difference.

In its method of invasion and replacement, as exemplified in voluntary muscle, Chicken Tumor XVIII differs from other chicken tumors thus far studied. Leaving out of consideration the method of pressure atrophy common to all, Chicken Tumor I, a spindle-celled sarcoma, destroys the muscle, either by a direct apposition of tumor cells to its fibers, associated with what may be called erosion, or by a direct extension into the interior of the muscle fibers and proliferation there. Figures illustrating this have been published.8 Chicken Tumor VII, the osteochondrosarcoma, replaces the muscle in both ways, doing so usually by the first. But Chicken Tumor XVIII, by means of strands of proliferating cells, splits up each muscle fiber longitudinally into a number of fragments which are then absorbed (figure 9). In cross-sections of the muscle at a certain period in the process of replacement a hundred isolated muscle bits, each apparently an atrophying unit, lie in the space normally occupied by twenty or thirty muscle fibers. They are derived indeed only from this number. During the replacement the preexisting blood spaces enlarge; intracanalicular growth into them takes place to greater or less extent; and there results a tissue irregularly subdivided by blood sinuses, and often to a large extent lying within them. The sinuses are always greatly compressed and nearly empty of cells. Many of the smaller clefts are not lined by endothelium, and are presumably artefacts due to shrinkage.

The extension of the tumor by invasion and replacement is more obvious than by expansion. Bone may be rapidly eroded. The firmness of the tissue is traceable to the large quantity of collagen distributed in it, often as thick, undulating ribbons or bundles. Next to these bundles the cells may be grouped regularly, in strata, but generally they lie in irregular strands or whorls, and the collagen fibers are irregularly distributed. In the more rapidly growing areas mitotic figures are frequent. There is a noteworthy

absence of giant cells. The cells have considerable uniformity but vary somewhat in size. The nucleus is large and vesicular, the cytoplasm scanty, and the cell outline that of a short spindle. More or less attenuated cells are frequent, and occasionally very slender ones are seen, grouped in strands, with rod-shaped nuclei, suggesting to some extent smooth muscle. Focal hydropic changes occur (figure 10) and rarely a mucinous degeneration.

In the later generations of the tumor, those of its rapid growth in Plymouth Rock fowls, it is usually a pure, spindle-celled sarcoma, fissured by a few flattened sinuses. It has become more cellular, though collagen fibrils still render it firm. Degenerative forms are still absent.

In very susceptible fowls no cellular reaction is found at the tumor's border except that associated with its support and vascularization. Always there is a total absence of histological features suggesting infection. In fowls relatively resistant, as shown by the tumor's slow growth, bands of scar tissue divide it irregularly, and small round cells, with some macrophages, are massed at its border and scattered within it. The neoplastic tissue disappears, not by necrosis en masse, but by a gradual absorption which is compatible with survival of the cells for a long time. The histological phenomena are quite similar to those associated with the retrogression of mammalian tumors⁹ and have been described at length in connection with another neoplasm of the fowl.¹⁰

**Resistant Hosts.**

The tumor has not grown in pigeons, rats, or mice. Ten individuals of each sort were inoculated with material that was active, as shown by the results in chickens. The tumor fails to grow in some chickens of the susceptible varieties, and in others, after a greater or less development, it retrogresses. The question whether retrogression results in a heightened resistance, has not been settled. Fowls in which the tumor is growing can be successfully reinoculated.

Chicken Tumor Due to Filterable Cause.

TRANSPLANTABILITY.

In studying the transplantability of the tumor the fate of bits of it implanted intradermally has been followed. In some fowls a suspension of the tumor tissue has been injected intravenously and the lungs examined later in serial section, but these inoculations, so successful with Chicken Tumor I, have not resulted in tumors. Similar negative results from intravenous inoculation are recorded of several neoplasms of the rat and mouse. The intradermal method has proven very satisfactory. Eight to ten tumor bits are implanted in each of a number of fowls, and are removed on successive days with the tissue about them, and submitted to serial section. In susceptible hosts the implanted cells survive, are vascularized, proliferate, and in a short time give rise to little tumors (figures 11, 12, and 13). The tissue, in other words, is transplantable. In resistant chickens the implanted material survives for a few days and may be vascularized, but perishes shortly in a mass of small, round cells. The findings will not be taken up in detail since they resemble those described for Chicken Tumor I.

DISCUSSION.

The growth described is in its structure, its method of enlargement, of retrogression and in its transplantability a tumor. Corroborative evidence of its neoplastic character is found in its effect on the host, in its limitation in transmissibility to one species, and in the complete natural resistance manifested by some individuals of the susceptible species. Several unsuccessful attempts have been made to cultivate from its tissue an etiological organism. The cultures either have remained sterile, or have shown diverse contaminations, such as sooner or later enter a growth transplanted without rigorous asepsis.

Every tumor has its peculiarities and in one particular Chicken Tumor XVIII is nearly unique. It tends to metastasize to the skeletal muscles, and this without localization in the viscera, and in


the absence of a patent foramen ovale or other short cut to the greater circulation. The facts might be taken to suggest that the growth's distribution occurs, not by cell emboli, but by means of some minute, infective agent, to which the pulmonary capillaries offer no barrier. As a matter of fact the paradoxical distribution of the metastases speaks neither for nor against an origin by cell emboli. It is true that pulmonary metastases are often the first step to the distribution of a growth by the greater circulation; and their presence furnishes good evidence for the dependence of this process upon cells: yet carcinoma and sarcoma both succeed rather frequently in passing the barrier of the pulmonary capillaries without the aid of lung tumors, so far as can be determined.\textsuperscript{18} Everyone with an experience at the autopsy table has met such cases. The slight recognition accorded them in text-books perhaps results from the endeavor to present in a sharp cut way the mechanics of cell distribution and the classical picture of a tumor.

Whether Chicken Tumor XVIII really metastasizes by means of cells cannot be determined from the data at hand. The general characters of the growth place it among the tumors and these, so far as we know, can be distributed only by cells. The tendency to localize in the muscles may be likened in its strangeness to the tendency of certain human neoplasms, for example, carcinoma of the prostate, to localize secondarily in the bones. In the case of Chicken Tumor XVIII the peculiarity attracts especial attention because of the many duplicate transplantation tumors that show it.

\textbf{RELATION TO CHICKEN TUMOR I.}

Though Chicken Tumor XVIII in its original form had few characters in common with Chicken Tumor I,—the first growth reported upon from this laboratory,—yet with repeated transplantation it has come to resemble it somewhat. Both are now spindle-celled sarcomata, with cells of medium size and very similar appearance. Both cause the host to waste away and die in coma. Filterable agents give rise to both. Chicken Tumor I was found in a Plymouth Rock fowl and its transplantation was for a long time

\textsuperscript{18} Zahn, F. W., \textit{Virchows Arch. f. path. Anat.}, 1889, cxvii, i.
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most successful in fowls of this sort, while Chicken Tumor XVIII, though occurring originally in a brown Leghorn chicken, has done strikingly well in Plymouth Rocks. It may properly be asked whether Chicken Tumor XVIII does not represent a form, originally much attenuated, of the disease which we know as Chicken Tumor I.

This does not seem to be the case. Despite a heightened malignancy which has rendered it of late more nearly comparable to Chicken Tumor I, Chicken Tumor XVIII has retained distinguishing characters, as can well be seen when both tumors are growing in one host at the same rate. Chicken Tumor XVIII is then observed to be a growth of fairly homogenous structure, firm from much collagen, and rarely necrotizing or becoming hemorrhagic; Chicken Tumor I is soft, and has a structure much varied by hemorrhage, necrosis, and mucoid degeneration. The giant cells and other degenerative forms which are a striking feature of Chicken Tumor I, are not found in Chicken Tumor XVIII. In certain brown Leghorn fowls in which both metastasized, Chicken Tumor I did so to the lungs and further viscera, while Chicken Tumor XVIII localized in the muscles and there only. When Chicken Tumor I is growing slowly in partially resistant hosts it does not exhibit the characters of Chicken Tumor XVIII in the earlier slowly growing generations, but keeps its own peculiarities. Finally, artificial attenuation of the agent causing Chicken Tumor I, by heating, or agents causing the two growths may nevertheless have some relationship to each other. The point remains to be investigated. But certainly the growths to which they give rise are separate entities.

SUMMARY.

A spontaneous chicken sarcoma, peculiarly fissured by blood sinuses, and with a tendency to intracanalicular extension into them, has been transplanted and studied in eight successive groups of fowls. Histologically the growth is a characteristic neoplasm, while in its transfer to new hosts a real transplantation is obviously involved. The development of the first few series of transplantation tumors was very slow. They exhibited the histological struc-
ture of the original growth and had the same tendency to metastasize to the skeletal muscles. Recently the tumor has grown more rapidly and in a higher percentage of hosts. With this has come a simplification of structure to that of a pure, spindle-celled sarcoma.

Fowls of an alien variety (Plymouth Rock) form quite as good hosts for the tumor as those of the sort (brown Leghorn) in which it was originally found. It has not grown in pigeons, rats, or mice.

The question of the cause of the tumor is not taken up in the present paper. It has been found to be due to an agent which will pass through Berkefeld filters. The growth is quite distinct in its characters from the other two transplantable neoplasms of the fowl (a spindle-celled sarcoma, an osteochondrosarcoma) which have such a cause. No growth like it has been observed among the forty-three spontaneous tumors of the fowl that have come under our observation.

EXPLANATION OF PLATES.14

PLATE 49.

Fig. 1. Chicken Tumor XVIII in the gizzard of the original fowl. Three metastases are visible in the skeletal muscles, namely one in the neck, another in the thoracic wall above the right lobe of the liver, and the third on the inner surface of the pelvis. All are indicated by arrows.

PLATE 50.

Fig. 2. Sagittal section through the gizzard and the primary growth.
Fig. 3. Sagittal section of the left leg of the original fowl to show the tumor masses in the muscles above and below the knee. Nearly all of the non-neoplastic tissue has been cut away. The extension of the growth into the joint cavity of the knee can be plainly seen.

PLATE 51.

Fig. 4. Margin of the growth in the gizzard of the original fowl. To the left are normal muscle and the mucous membrane of the gizzard cavity. The dilatation of blood spaces that precedes the invasion of the growth should be noted, and the general absence of a cellular reaction. Many of the growth's subdivisions show an interstitial hydropic change, and at the extreme right its tissue is necrotic.
Fig. 5. Section through the tumor mass in the leg of the original host, to show the fissured character of the growth. The darkly stained bodies in the vessels are the nucleated red cells of the fowl.

14 All the microscopic sections were stained with eosin and methylene-blue.
Chicken Tumor Due to Filterable Cause.

PLATE 52.

Fig. 6. Chicken Tumor XVIII in a fowl of the second generation, dying five and one half months after inoculation. The primary masses lie in the pectoral muscle to either side of the sternum. There are large secondary tumors in the muscles of both legs and in one wing. A small tumor nodule overlies the first joint of the other wing. The emaciation of the fowl is largely concealed by the growths.

Fig. 7. Section of the tumor in a fowl of the third generation, series A. The heavy black dots scattered here and there are artefacts. The fissured, intracanalicular structure is well shown.

PLATE 53.

Fig. 8. A metastasis in the lung. The growth is here a pure, spindle-celled sarcoma. The fissured primary tumor is shown in figure 7.

Fig. 9. Chicken Tumor XVIII replacing striped muscle. The muscle fibers are split up by the growth into numerous small fragments.

PLATES 54 AND 55.

Fig. 10. Section of another part of the same tumor, showing focal, hydropic degeneration. In the undegenerated area collagen fibrils are numerous.

Figs. 11, 12, and 13. Three grafts of Chicken Tumor XVIII shown in cross-section with the surrounding tissue. All were implanted at the same time in a susceptible, normal fowl and removed one, two, and three days later, respectively. They lie just beneath the epidermis in the pars reticularis of the corium.

The graft removed one day after implantation is unattached and its cells are living except toward the center of the fragment where necrosis is already apparent. There is some cellular reaction about the tumor bit removed at the end of the second day. Though as yet unvascularized, it is here and there attached to the host tissue, and most of its cells are living. At the end of the third day vascularization has occurred, and the tumor cells, successfully transplanted, are proliferating and extending into the host tissue.
Fig. 1.

(Rous and Lange: Chicken Tumor, Due to Filterable Cause.)
FIG. 2.

FIG. 3.
(Rous and Lange: Chicken Tumor Due to Filterable Cause.)
(Rous and Lange: Chicken Tumor Due to Filterable Cause.)
(Rous and Lange: Chicken Tumor Due to Filterable Cause.)
(Rous and Lange: Chicken Tumor Due to Filterable Cause.)
FIG. 10.

FIG. 11.

(Rous and Lange: Chicken Tumor Due to Filterable Cause.)
Fig. 12.

Fig. 13.

(Rous and Lange: Chicken Tumor Due to Filterable Cause.)