

ON THE GREATER SUSCEPTIBILITY OF AN ALIEN VARIETY OF HOST TO AN AVIAN TUMOR.*

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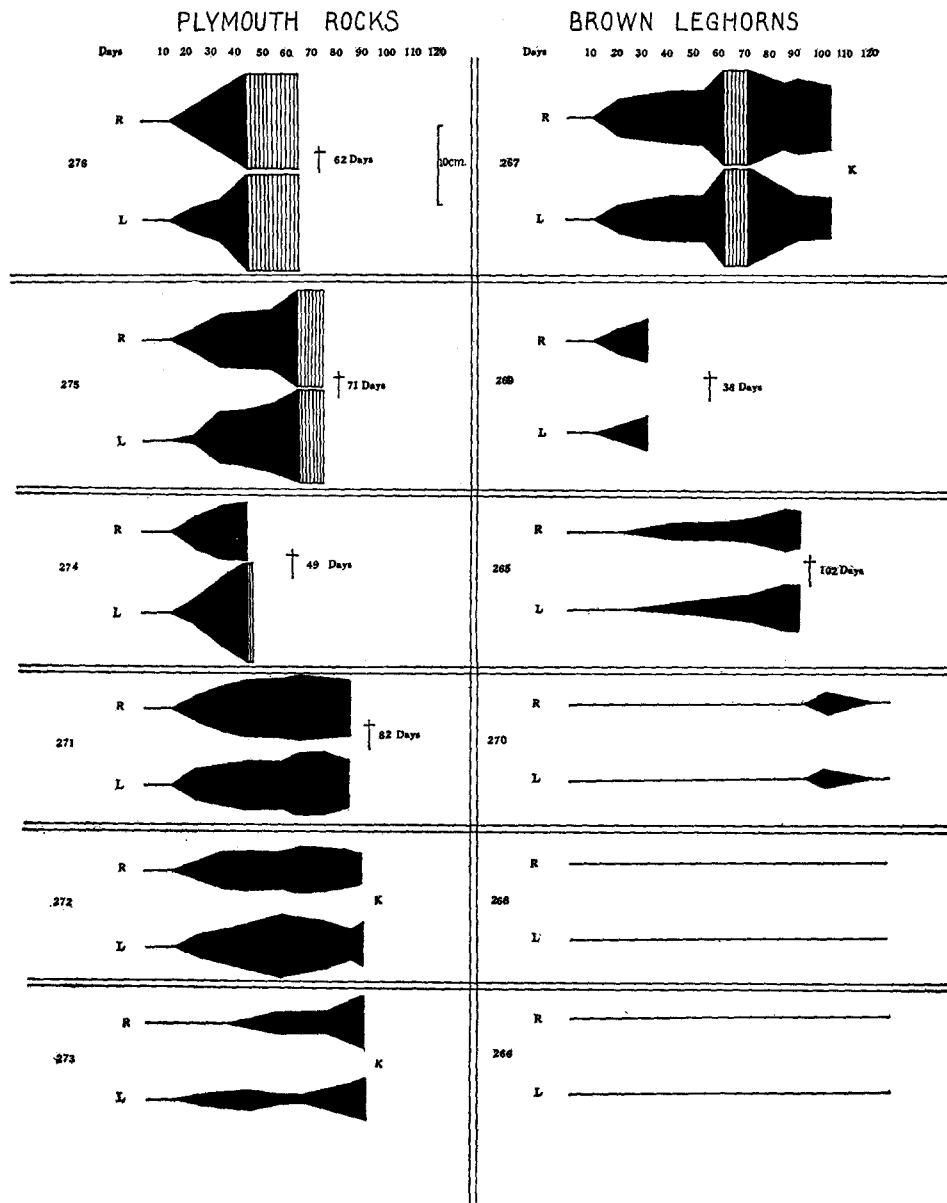
(From the Laboratories of The Rockefeller Institute for Medical Research.)

It has been the general experience of workers with transplantable tumors that they are most readily propagated in animals of the variety in which they appear as spontaneous growths (Jensen, Loeb). Some tumors are so specific in their demands as to grow only in individuals from certain sources and not in others of the same race. A spindle-celled sarcoma of the fowl studied in our laboratory was successfully transferred at first only to blood relations of the original host. In fowls of the same variety, but unrelated, it did not grow. The purpose of the present paper is to record an instance in which the behavior of a tumor was against the rule, its transplantation taking place more readily to hosts of an alien variety. Such instances are so rare as to deserve special report.

The growth in question, a tumor of the fowl (Chicken Tumor XVIII), has already been described at length.¹ It is a spindle-celled sarcoma curiously rifted with blood sinuses, and showing a tendency to metastasize to the voluntary muscles. It originated in a brown Leghorn hen, and was transferred to two successive series of such hosts, in which it grew slowly but with some increase in the percentage of takes. Of the third series of fowls inoculated several were barred Plymouth Rocks, and in these the tumor grew with especial rapidity. On subsequent inoculation to other barred Plymouth Rocks its growth was still more rapid. The findings seemed attributable either to an enhanced malignancy consequent on passage and independent of the host's variety, or to some special susceptibility of the Plymouth Rock breed. To test the matter a number of comparative inoculations were made.

* Received for publication, August 1, 1914.

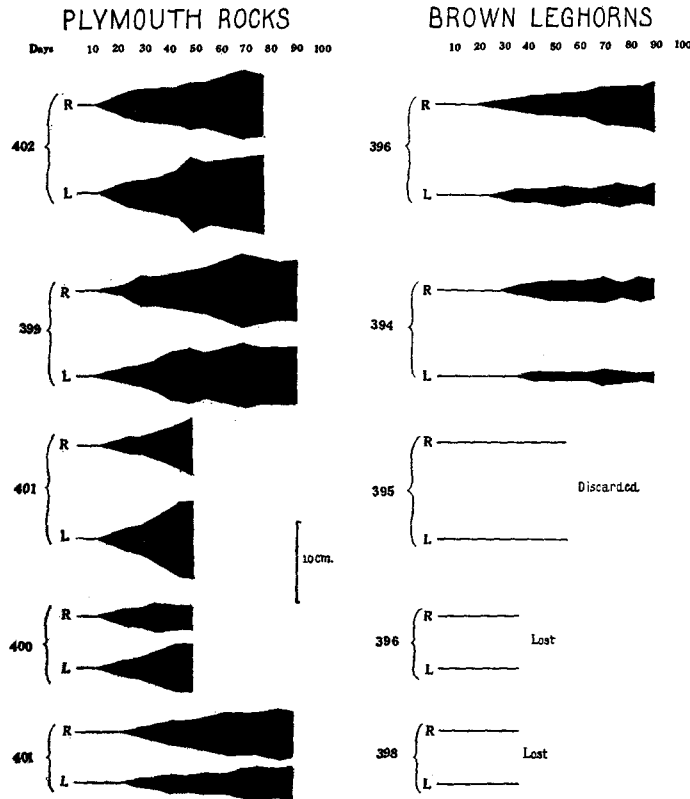
¹ Rous, P., and Lange, L. B., *Jour. Exper. Med.*, 1913, xviii, 651.



TEXT-FIG. 1. Results of the inoculation into Plymouth Rock and brown Leghorn fowls of bits of the rifted sarcoma taken from a Plymouth Rock. Two inoculations were made into each fowl. The time of appearance and rate of growth of the tumors are shown by diagrammatic outlines of which the width indicates the diameter of the tumor, and the length the period of growth. A hatched outline indicates that the tumor had filled the whole breast and could not be accurately measured. R and L = tumors of right and left breast. K = killed. The changes in size of the tumors appear abrupt, but this is because the measurements were taken at considerable intervals.

Experiment 1.—Small bits of fresh tumor tissue, of approximately equal size, from a barred Plymouth Rock fowl were implanted through a trocar, one in each breast of six brown Leghorn adults and six Plymouth Rocks. The results of the transplantation are shown in text-figure 1.

Experiment 2.—The tumor material was taken from a brown Leghorn inoculated in the preceding experiment. Implantations were made as before into each breast of five Plymouth Rock and five brown Leghorn fowls (text-figure 2).



TEXT-FIG. 2. Results of the inoculation into Plymouth Rock and brown Leghorn fowls of bits of the rifted sarcoma from a brown Leghorn fowl of the experiment recorded in text-figure 1.

Text-figure 1 shows that the sarcoma taken from a Plymouth Rock fowl and inoculated into Plymouth Rocks and brown Leghorns appeared in a smaller percentage of the latter and after a longer interval, and grew less well. This was also the case when

the material was derived from a brown Leghorn fowl (text-figure 2). Further observations have confirmed these findings. It may be urged that in the experiments figured, the results were due to an adaptive change in the tumor consequent upon its growth in several series of Plymouth Rocks, and not to be altered by sojourn in a single series of brown Leghorns. But as already mentioned, results entirely similar were obtained with the first Plymouth Rock fowls inoculated.

There are certain obvious physical differences between brown Leghorn and Plymouth Rock chickens to which the results might, conceivably, be due. The one breed is small and wiry, whereas the other is large and fat. Other things being equal, one might suppose that as hosts for all sorts of proliferating tissue the Plymouth Rocks would be better. To throw light on this point fowls of both varieties were inoculated with Chicken Tumor I, a simple spindle-celled sarcoma. This growth has already been mentioned for the striking specificity whereby its successful transplantation was at first confined to blood related Plymouth Rocks. It is now very malignant and grows well in chickens of many breeds.

Experiment 3.—Inoculations of Chicken Tumor I from a Plymouth Rock hen were made, as in experiments 1 and 2, into each breast of five Plymouth Rock and five brown Leghorn fowls. The results are given in text-figure 3.

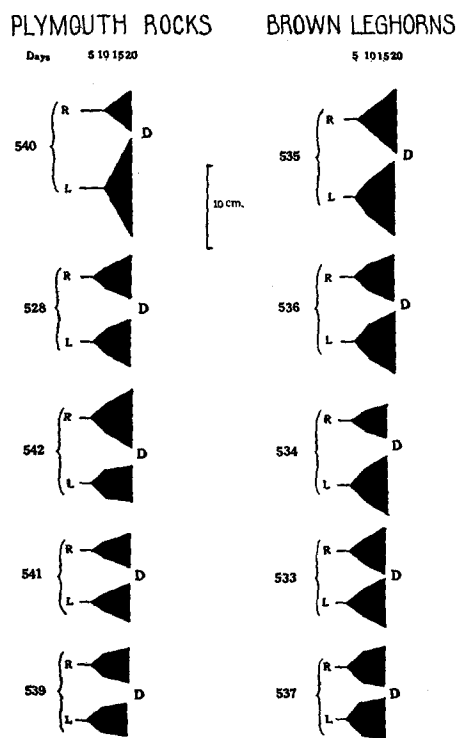
It will be seen (text-figure 3) that the tumor succeeded equally well in both varieties of fowls,—and this despite its early predilection for Plymouth Rocks. The findings with the rifted sarcoma can hardly be attributed then to gross physical differences in the chickens used.

Like our other transplantable chicken tumors the rifted sarcoma has a filterable agent as its cause. Yet in its transfer to new hosts, as carried out by introducing a bit of the fresh tumor tissue, a genuine transplantation is ordinarily involved, the new tumor arising by the survival and proliferation of the implanted fragment. The marked success of the sarcoma in hosts of an alien variety might conceivably be due either to an influence exerted on the transplanted cells or directly on the agent causing the disease. The results of a filtration experiment furnish some evidence for the latter view.²

² Rous, P., and Murphy, Jas. B., *Jour. Exper. Med.*, 1914, xix, 52.

Experiment 4.—Four Plymouth Rock fowls and four brown Leghorns were inoculated with equal portions of a Berkefeld filtrate prepared from the fresh tissue of the rifted sarcoma. A little sterile diatomaceous earth was added to the filtrate prior to its injection. The tumor used came from a Plymouth Rock fowl to which it had been transplanted after growing in two series of brown Leghorns.

The inoculated fowls were kept several months under observation. Two of the four Plymouth Rocks developed growths from which they eventually died. Of the four brown Leghorns only one developed a growth and this retrogressed.



TEXT-FIG. 3. Results of the inoculation of bits of the simple spindle-celled sarcoma into Plymouth Rock and brown Leghorn fowls. The tumor material was obtained from a Plymouth Rock.

No further experiments of the sort have been made because of the difficulty of obtaining the causative agent of the rifted sarcoma in active form. Unlike the agents causing our other chicken tumors it does not survive in the dried or glycerinated tumor tissue. Moreover, its activity in filtrates is very inconstant, and at best tumors are not produced until several months after the injection.

Among the numerous instances of the influence of race on the transfer of mammalian tumors we have been able to find but one in any way parallel to that here recorded. Tyzzer³ transplanted a tumor of the Japanese mouse to hybrids of this breed and the ordinary white mouse, a variety completely insusceptible to the growth. In the F₁ generation of hybrids the tumor succeeded much better than in the Japanese mice. It may perhaps be remarked in this connection that Plymouth Rock fowls represent a mixture of several strains.

SUMMARY.

A transplantable sarcoma of the fowl, known as Chicken Tumor XVIII, in our series, succeeds better in chickens of an alien breed (Plymouth Rock) than in those of the variety in which it originated (brown Leghorn). This is not due to gross physical differences in the two breeds but to some more subtle factor and one which perhaps acts by influencing the agent causing the tumor. It would seem that Chicken Tumor XVIII, as it occurred in nature, was an instance of a disease appearing spontaneously in an animal of relatively insusceptible variety.

³ Tyzzer, E. E., *Jour. Med. Research*, 1909, xxi, 519.