BREAKING DOWN THE RESISTANCE OF ALBINO MICE TO THE
TRANSPANTATION OF TUMORS INDUCED BY 1:2:5:6-
DIBENZANTHRACENE IN A DIFFERENT STRAIN
OF ALBINO MICE

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The difficulty encountered in transplantation of cancerous tissue, even
from one strain of animals into another of the same species, has long been
recognized (Loeb, 1901). Lately, the careful observations of many inves-
tigators (Strong, 1922; Wood and Curtis, 1922; Loeb, 1918; Woglon, 1929),
particularly those on the transplantability of the spontaneous mouse carcinoma
(Bittner, 1929, 1933, 1935) and of the induced mouse sarcoma (Andervont,
1934, 1935), have established the fact that the malignant tissues arising in
mice of brother-to-sister mating strains is transplantable only into individuals
of the same strain or, to a lesser degree, hybrids of that strain. Andervont
(1934) showed this strain specificity for the induced 1:2:5:6-dibenzanthra-
cene tumors in a number of strains of mice. He found that 4 tumors induced
in the A strain of mice, when inoculated into 17 mice of the same strain,
gave 17 tumors; but when inoculated into 23 mice of C57 strain, 25 mice of
D strain, and 20 mice of stock albino strain, failed to produce a single tumor.
Two tumors induced in CBA strain, inoculated into 10 mice of CBA strain,
gave rise to tumors in 5 of the animals; but when inoculated into 10 mice of
C57 strain and 6 mice of D strain gave completely negative results. Two
tumors induced in mice of M strain, inoculated into 19 mice of M strain,
resulted in the growth of a tumor in every instance, but failed to give rise to
a single tumor when inoculated into 13 mice of D strain and 7 mice of C57
strain. Two tumors induced in mice of D strain, inoculated into 29 mice of
D strain, resulted in 29 tumors, but failed to produce any tumor growth when
inoculated into 11 mice of C57 strain and 8 mice of M strain. A tumor in-
duced in a mouse of C57 strain gave rise to 18 tumors when inoculated into
18 mice of C57 strain, but remained negative in 8 mice of CBA strain and
6 mice of D strain.

In our own experiments, using a pure inbred strain of Bagg albino mouse,
we found that the tumors induced in brother-to-sister mating strains were
transplantable 100 per cent into mice of the same strain, but not into mice
of different inbred strains. Fragments of tumors induced in C57, in A, in
dilute brown and in C37 strains of mice, inoculated into more than 100 Bagg
albino mice, in no instance gave rise to a tumor. On the other hand, frag-
ments of these tumors never failed to grow in mice of the same strain as that
in which the tumors arose. From these numerous experiments it would seem

1 This investigation was aided by a grant made to Dr. Warren H. Lewis by the International
Cancer Research Foundation.
justifiable to conclude that induced 1:2:5:6-dibenzanthracene tumors are transplantable only into mice of the strain in which these tumors originate.

This peculiarity of induced tumors, which results in ready growth of the transplanted cells in mice of the same strain and destruction of the malignant cells in mice of a different strain, led M. R. Lewis to undertake studies upon a possible foreign protein reaction of the mice toward the tumor tissue. As a result of these investigations it was found that certain mice could be so altered by frequent inoculations of tumor tissue from a different strain as to permit the ultimate transplantation of such tumors.

The mice used in the present experiments were the pure inbred Bar Harbor albinos (A strain) and the brother-to-sister mating Bagg Albino mice ("BA" strain). An unforeseen shortage of the A strain of mice prevented carrying out the experiments as completely as was desired.

The tumors used were transplanted sarcoma induced in mice of the A strain by means of 1:2:5:6-dibenzanthracene dissolved in lard. They were sent to us by Dr. Howard Andervont of the Public Health Service, Boston, Mass., and were called PHS 2, 4, 5, 6, 7, 9, 10, 11, 12, 14, 17 and 20, numbered in the order in which the primary tumors arose in Dr. Andervont's mice. The tumors were carried by transplantation into mice of A strain in our laboratory. All of these inoculated mice developed tumors; but inoculations from the same tumors into BA mice (over 100) failed to produce tumors in a single instance.

Twenty-four BA mice that had proved refractory to inoculation of the A strain tumors one to two months previously were selected for a study of the effect of repeated inoculations of these tumors. The mice were inoculated about every five days with a small piece of one of the A tumors. Inoculations were started in 6 of the animals on Dec. 5, and forty-three days later were begun in the other 18. During this time each of the first 6 animals received seven inoculations of A strain tumors—PHS 11, 12, 6, 5, 17, 11 and 20, in the order listed. Two of the mice (No. 3 and No. 6) developed tumors and were not inoculated further. Mouse 3 had three tumors and Mouse 6 two tumors (see Plate I and Protocols). On Jan. 31 one of the tumors in Mouse 3 (PHS 6) was transplanted into 2 normal Bagg albino mice, where it grew so rapidly that the mice were discarded two weeks later. After tumors developed in these mice all subsequent inoculations were made at definite sites, for the purpose of identification of any tumors that might appear.

Of the remaining 4 mice of the first group of 6, one (No. 5) died after the ninth inoculation without having developed a tumor. Two others that had remained negative (No. 1 after the fourteenth and No. 2 after the nineteenth inoculation) were tested to see whether they had become immune to the growth of tumor. For this purpose they were inoculated with a piece of a tumor that had been induced in their own strain (Bagg albino). This tumor tissue grew in each of these mice, showing that the destruction of many pieces

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2 The pure inbred Bar Harbor Albino (A strain) were sent to us by Dr. Clarence C. Little from the Rosecb B. Jackson Memorial Laboratory, Bar Harbor, Maine.

3 The Bagg albino mice were sent to us by Dr. E. C. MacDowell from the Department of Genetics, Carnegie Institution, Cold Spring Harbor, New York.
PIATE I

FIG. A: Diagram showing that the mice of the "A" strain were susceptible and mice of the Bagg Albino strain refractory to each of the "A" strain tumors used in these investigations.

Figs. 1–24: Diagrams of the 24 Bagg Albino mice inoculated with tumors from the "A" strain mice.

The minus sign shows to which tumor the mouse had been refractory, and the numbers and their locations indicate where each of the A strain tumors was inoculated. The outlines of the tumors with enclosed numbers show the location and the type of A strain tumor that developed in each mouse.

Mouse 5 and Mouse 13 died before developing tumors. Mouse 1, Mouse 2, and Mouse 18 were refractory to all the types of A strain tumors whose numbers are given, but nevertheless proved susceptible to a tumor of the BA strain; the location of this tumor is indicated by the faint outline of a tumor.

The protocols for the individual mice are given on pp. 253–255.
of tumor from the A strain had not rendered the animals immune to the growth of a tumor from their own strain. The fourth mouse (No. 4) received 14 inoculations of A tumors and developed 5 tumors. One of these was PHS 20 and four were PHS 9 (Plate I, Fig. 4).

Table I shows the type of tumor, the date, order, site and results of thirteen inoculations made into the second lot of mice (18 in number) during

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<th>6</th>
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18 BA Mice
6 Mice

24 Mice
54 Total Tumors

Eighteen Bagg albino mice were inoculated on the dates given with PHS 17 into right axilla, PHS 20 into left axilla, PHS 9 into right groin, PHS 9 into right thigh, PHS 9 into left thigh, PHS 10 into left groin, PHS 14 into nape of the neck, PHS 9 into right shoulder, PHS 14 into left shoulder, PHS 3 into base of the tail, PHS 20 into the right side, PHS 14 into the left side and PHS 9 into the middle of the back. The mice were examined and the appearance of each tumor recorded after it had shown evidence of growth longer than a week.

Mouse 24 had a slight nodule in the right axilla from a previous inoculation of PHS 7, which had shown no growth for over a month. For this reason, this mouse was not inoculated again at that site; therefore, when this tumor later began to grow, following repeated inoculation, it was considered as the first inoculation.

The early inoculations in most instances failed to grow, the few tumors that did develop made their appearance slowly. The tumors that developed from the later inoculations grew rapidly and progressively.

In all, 44 A-tumors developed in the 18 Bagg albino mice recorded in the chart.

The six mice of the first group not recorded on the chart developed 10 tumors, so that 54 tumors developed in the 24 mice used in the experiment.

a period of fifty-nine days, beginning Jan. 17. One mouse (No. 13) died while still negative, after 8 inoculations. Another (No. 18), which had resisted eight inoculations of A strain tumor, was tested for immunity by the inoculation of a BA strain tumor, to which it proved susceptible. In this mouse and also in mouse No. 1 and No. 2, each of which was tested for immunity, the growth of the transplanted Bagg albino tumor did not stimulate the growth of any of the A strain tumor implants which had failed to grow in these mice. The other 16 mice all developed tumors, so that these 16, together
with the 3 of the first group of 6 mice, made 19 out of the 24 mice inoculated successively that developed tumors. Two mice had only one, 6 had two, 6 had three, 3 had four, and 2 had five tumors, a total of fifty-four tumors in 19 mice.

A survey of the diagrammatic sketches of the 24 mice in Plate I indicates that there was no site in which a tumor always developed, no tumor that developed in every mouse, and no mouse that developed all the tumors. In only one instance (Mouse 24, PHS 7) did a tumor develop before the sixth inoculation, although some of the tumors that did develop after the sixth inoculation had been inoculated earlier. The tumors that arose from the later inoculations usually grew progressively. Of the tumors used, six types grew (PHS 7, 6, 11, 9, 14 and 20). Three types (PHS 5, 10 and 17) failed to grow in any of the mice.

Most of the tumors inoculated, even those that later regressed, exhibited some immediate growth and considerable hyperplasia of the host's tissue around the implanted pieces. For this reason the growth that took place in the first week was not recorded. Some of the tumors attained a size of 2 to 5 grams before the mouse died. Tumors that weighed less than 300 mg., a little more than twice the size of the spleen of a normal young mouse, were not recorded.

Toward the conclusion of the experiment, as each tumor was used to inoculate the experimental BA mice it was also inoculated into 6 normal young Bagg albino mice to determine whether the tumors had become changed during transplantation so as to permit their growth in the Bagg albino mice. The tumors thus inoculated were PHS 5, 9, 14 and 20. In a number of the normal mice inoculated with these tumors there occurred some immediate growth, as is usual, but this soon regressed and all the mice remained negative.

Owing to the shortage of the A strain of mice, only two of the tumors that developed in the Bagg albinos were inoculated into both the A strain and BA strain mice. These were PHS 9 from Mouse 14 and PHS 20 from Mouse 12. Both tumors grew in mice of both strains.

Seven other A strain tumors that developed in the repeatedly inoculated Bagg albinos were transplanted into normal young Bagg albino mice. These were PHS 6 from Mouse 4, PHS 9, 14, and 20 from Mouse 9, and PHS 9, 14, and 20 from Mouse 15. PHS 6 grew in the 2 mice inoculated; PHS 20 grew in 9 of the 12 mice inoculated; PHS 9 developed into tumors in 5 of the 12 mice inoculated, but regressed in the others. PHS 14 grew in 7 of the 12 mice inoculated. Although the A tumors that developed in the BA mice following frequent inoculations did not grow in all the BA mice into which they were later passed, they did grow in a sufficient number to justify the conclusion that the A strain tumors which developed in the BA mice following successive inoculations were transplantable into mice of both the A and the BA strains.

Since these observations were somewhat similar to those of certain investigators in regard to foreign protein reactions, it seemed of interest to determine whether the spleen might play any part in these results. Accordingly, 4 mice of the BA strain and 2 of A strain were splenectomized.¹

¹ We are indebted to Dr. Calista Eliot and to Dr. Donald H. Hooker, who removed the spleens from the mice.
A few days later 3 of these mice (2 of the BA and 1 of the A) were inoculated with the A strain tumor PHS 11, and the remaining 3 with the A strain tumor PHS 12. Both tumors grew rapidly in the 2 A mice and brought about death, but neither type grew in the 4 BA mice. Four other mice (3 of Dr. Andervont's stock albino and 1 dilute brown mouse) were splenectomized and six weeks later inoculations with the A strain tumors were started in the 8 splenectomized animals and repeated every five days, in order to determine whether these mice would be more or less susceptible to that strain of tumor. The small number of A strain mice available for carrying the A strain tumors prevented more than five successive inoculations. One tumor developed after the fifth inoculation. While this is by no means conclusive evidence, it would, nevertheless, seem to indicate that the splenectomized mice were not appreciably more susceptible than the non-splenectomized ones. On the other hand, the fact that one tumor did develop would suggest that with succeeding inoculations the mice might have become susceptible to some of the A strain tumor.

A few mice of the A strain were inoculated, some every five days, others at shorter intervals, with A strain tumors. The tumors developed so rapidly in all of these mice that the experiment was discontinued.

**Summary**

Table I shows the kind of tumor used, the site, and the order of inoculation, also the time when the tumors first appeared and the number of tumors that developed in 18 of the Bagg albino mice that received successive inoculations of tumors from the A strain mice.

Plate I is a diagrammatic representation of each of the 24 Bagg albino mice. The tumor to which each mouse had been refractory is indicated by a minus sign. The site into which and the tumors with which the mice were inoculated, as also the tumors that developed, are shown.

The protocols give a short history of each mouse. A glance at these records will demonstrate the diversity of results obtained in the different mice.

Before the successive inoculations were begun, it had been determined that the Bagg albino mice were refractory to the growth of each of the tumors used and that mice of the A strain were susceptible to all of them.

All the Bagg albino mice used for repeated inoculations had already been inoculated one or two months previously with one of the A strain tumors and had remained refractory to it.

Of the 24 Bagg albino mice that were inoculated about every five days with one of the A strain tumors, 2 (Nos. 5 and 13) died; 3 (Nos. 1, 2 and 18) were tested for immunity by inoculation with tumors from their own strains, to which they proved susceptible; the other 19 mice each developed one or more tumors (Plate I). Two of them had 1 tumor, 6 had two, 6 had three, 3 had four, and 2 had five tumors, making fifty-four tumors in the 19 mice. One of the tumors was PHS 7, one was PHS 6, two were PHS 11, nine were PHS 14, eighteen were PHS 9, and twenty-three were PHS 20. Three of the tumors (PHS 5, 10, and 17) failed to grow in any of the mice.

Seven of the A strain tumors that developed in the repeatedly inoculated
Bagg albino mice were transplantable into 23 of the 38 normal young Bagg albino mice into which they were inoculated. Two other A strain tumors that developed in successively inoculated Bagg albino mice (PHS 9, Mouse 14, and PHS 20, Mouse 12) were transplantable into every one of the inoculated mice of the A strain and of the BA strain.

Of the 226 inoculations made into the 24 mice, 54 developed into tumors. Splenectomized mice of the A strain were susceptible to tumors from an A strain. Splenectomized mice of BA strain were refractory to tumors from the A strain. Splenectomized BA mice inoculated repeatedly with tumors from the A strain did not develop tumors any more rapidly than did the non-splenectomized mice.

Conclusion

The results of the experiments show that the resistance of the Bagg albino mice to the transplantation of tumors induced in mice of the A strain by means of 1:2:5:6-dibenzanthracene was broken down by frequent inoculations of pieces of the tumors to which they had at first proved refractory.

Tumors of the A strain that developed in previously refractory Bagg albino mice as a result of repeated inoculations were to some extent transplantable into both the refractory strain and the strain in which the tumors originated.

The repeated immediate growth and later regression of pieces of A strain tumors that took place in the BA mice that remained refractory to successive inoculations of A strain tumors did not render the mice immune to the transplantation of tumors induced in their own strain.

Protocols of Mice Shown Diagrammatically on Plate I

BA Mouse 1, refractory to PHS 13, received 14 inoculations of A strain tumors (PHS 11, 12, 6, 5, 17, 11, 20, 20, 19, 14); inoculated every five days beginning Dec. 5. It was negative on Feb. 25 and was then inoculated with tumor from the Bagg albino strain to see whether the mouse was immune to tumor growth. This inoculation developed a tumor but did not stimulate the growth of any of the earlier inoculations of tumors from a different strain.

BA Mouse 2, refractory to PHS 13, received 19 inoculations of A strain tumors, beginning Dec. 5 and continuing until March 16. This mouse remained negative and was tested for immunity at the end of the experiment by inoculation with a BA tumor, to which it was susceptible.

BA Mouse 3, refractory to PHS 17, received 7 inoculations of A strain tumors (PHS 11, 12, 6, 5, 17, 8, 20); 3 of these developed into tumors. The first tumor, PHS 11 (sixth inoculation), appeared thirty days after successive inoculations were begun; two other tumors appeared and grew rapidly. The mouse was not inoculated further. It was moribund fifty-seven days after inoculations were begun, with three large tumors, PHS 11, 6, and 20. A strain tumor PHS 6, developed in this Bagg albino, was inoculated into 2 normal BA mice where it developed so rapidly that fourteen days later these mice had to be discarded.

BA Mouse 4, refractory to PHS 6, received 14 inoculations of A strain tumors (PHS 11, 12, 6, 5, 17, 11, 20, 20, 9, 9, 10, 14, 9), beginning Dec. 5. Five of these developed tumors. The first was PHS 20 (eighth inoculation); following this the ninth, tenth, eleventh and fourteenth inoculations, all of which were PHS 9, grew rapidly. Fifty-one days after the successive inoculations were begun the mouse was dying with five large tumors, four of them PHS 9 and one PHS 20.
B1 Mouse 5, refractory to PHS 5, received 9 inoculations of A strain tumors, beginning Dec. 5. It remained negative until it died on Jan. 25.

B1 Mouse 6, refractory to PHS 5, received 7 inoculations of A strain tumors (PHS 11, 12, 6, 5, 17, 11, 20). Two tumors developed. The first appeared thirty days after the successive inoculations were begun, and the mouse was discarded in sixty-one days with two large tumors, PHS 11 (sixth inoculation) and PHS 20 (seventh inoculation).

B1 Mouse 7, refractory to PHS 14, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 14, 9, 14, 5, 20, 14). Three tumors developed. The first, PHS 20 (second inoculation), appeared after the ninth inoculation, forty-five days after inoculations were begun. Two other tumors appeared and grew rapidly, and fourteen days later the mouse was moribund with three large tumors—PHS 20 (second inoculation), PHS 14 (eighth inoculation), and PHS 20 (eleventh inoculation). These tumors weighed 5550 mg. and the mouse weighed 17,200 mg.

B1 Mouse 8, refractory to PHS 14, received 13 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14, 9). Two tumors developed, PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation). These tumors grew rapidly from the time of inoculation.

B1 Mouse 9, refractory to PHS 14, received 13 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14, 9). Only PHS 20 (eleventh inoculation) developed a tumor. PHS 14 (twelfth inoculation) grew for a time but later regressed.

B1 Mouse 10, refractory to PHS 17, received 13 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14, 9); 3 tumors developed. The first, PHS 9 (eighth inoculation, as well as PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation), continued to grow from the time of their inoculation. PHS 9 weighed 2100 mg., PHS 20 weighed 2800 mg. and PHS 14 weighed 1200 mg. On March 26, sixty-nine days after inoculations were begun, each of these tumors was inoculated into 6 normal young BA mice, and every mouse developed a small tumor. After two weeks, however, some of these tumors started to regress, and at the end of three weeks only seven large tumors had developed. These were one PHS 9, three PHS 14, and three PHS 20.

B1 Mouse 11, refractory to PHS 17, received 9 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14). Three tumors developed. The first, PHS 20 (second inoculation), appeared after the sixth inoculation and twenty-nine days after the inoculations were started. The second tumor, PHS 9 (fourth inoculation), and the third tumor, PHS 9 (fifth inoculation), also appeared at this time. The mouse died thirty-nine days after the inoculations were begun, with three large tumors.

B1 Mouse 12, refractory to PHS 17, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14). It developed 3 tumors. The first, PHS 20 (second inoculation), appeared after the sixth inoculation and grew slowly. No more tumors developed until after the ninth inoculation; then PHS 9 (eighth inoculation) and PHS 20 (eleventh inoculation) appeared and grew rapidly. The mouse was discarded fifty-nine days after successive inoculations were begun, with two large and one small tumor. PHS 20 weighed 2500 mg., PHS 9 weighed 1400 mg., and PHS 20 weighed 1400 mg. PHS 20 from this mouse was transplanted into mice of both the A strain and the BA strain. It grew rapidly in both.

B1 Mouse 13, refractory to PHS 12, received 9 inoculations of A strain tumors. It remained negative until it died, Feb. 25.

B1 Mouse 14, refractory to PHS 12, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20 and 14). Four tumors developed. The first, PHS 20 (second inoculation), and the second, PHS 9 (fourth inoculation), appeared after the seventh inoculation. PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation) grew progressively. The two PHS 20 tumors together weighed 6150 mg., PHS 9 weighed 1500 mg., and PHS 14 weighed 360 mg. PHS 9 from this mouse was transplanted into mice of both the A and the BA strains. It grew rapidly in both.

B1 Mouse 15, refractory to PHS 12, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14). Four tumors developed. The first, PHS 20 (second inoculation), appeared after the eighth successive inoculation, thirty-nine days after the inoculations were begun. Following this PHS 9 (third inoculation), PHS 9
BREAKING DOWN THE RESISTANCE OF ALBINO MICE

(eighth), and PHS 14 (ninth) grew rapidly. The mouse was used March 11, fifty-four days after the successive inoculations were begun, and tumors PHS 20, PHS 9 and PHS 14 from this mouse were each transplanted into 6 BA mice. The 6 mice that received PHS 20 all developed tumors; 4 of those that received PHS 14 developed large tumors, while one mouse died, and in one, although the tumor grew somewhat, it remained a small nodule; 4 of those that received PHS 9 developed large tumors, but in 2 of the mice the tumor remained small.

**BA Mouse 16,** refractory to PHS 4, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20 and 14). Only one tumor, PHS 20 (eleventh inoculation), developed. PHS 14 (twelfth inoculation) grew rapidly for ten days, and then regressed. This mouse had a litter after the fifth inoculation.

**BA Mouse 17,** refractory to PHS 4, received 13 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20, 14 and 9). Two tumors developed, PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation), which grew rapidly.

**BA Mouse 18,** refractory to PHS 4, received 8 inoculations of A strain tumors (PHS 17, 20, 9, 9, 10, 14, 9). It remained negative and so was inoculated with a BA strain tumor. This grew, showing that the mouse was not immune to transplantation of a tumor of its own strain.

**BA Mouse 19,** refractory to PHS 7, received 13 inoculations (PHS 17, 20, 9, 9, 10, 14, 9, 14, 5, 20, 14 and 9). Three tumors developed, PHS 9 (eighth inoculation), PHS 20 (eleventh inoculation), and PHS 14 (twelfth inoculation), which grew progressively. The mouse died sixty-nine days after successive inoculations were begun, with three large tumors.

**BA Mouse 20,** refractory to PHS 7, received 12 inoculations of A strain tumors (PHS 17, 20, 9, 9, 9, 10, 14, 9, 14, 5, 20 and 14). Four tumors developed. The first, PHS 20 (second inoculation), appeared after the eighth successive inoculation; PHS 9 (eighth inoculation), PHS 20 (eleventh inoculation), and PHS 14 (twelfth inoculation) grew progressively. When the mouse was discarded, fifty-nine days after inoculations were begun, it had three large tumors and one small one. PHS 20 weighed 1250 mg., PHS 9 weighed 1300 mg., PHS 20 weighed 798 mg., and PHS 14 weighed 400 mg. The mouse weighed 15 grams.

**BA Mouse 21,** refractory to PHS 20, received 13 inoculations of A strain tumors (PHS 17, 20, 9, 9, 10, 14, 9, 14, 5, 20, 14 and 9). Two tumors developed. The mouse remained negative for forty-nine days, after which PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation) grew rapidly.

**BA Mouse 22,** refractory to PHS 20, received 13 inoculations of A strain tumors. Two tumors developed. The mouse remained negative for forty-nine days, after which PHS 20 (eleventh inoculation) and PHS 14 (twelfth inoculation) appeared and grew rapidly.

**BA Mouse 23,** refractory to PHS 20, received 8 inoculations of A strain tumors. Two tumors developed. The first, PHS 20 (second inoculation), appeared after the sixth inoculation, and shortly after this PHS 9 (fourth inoculation). The mouse died thirty-nine days after the inoculations were begun, with two large tumors.

**BA Mouse 24,** refractory to PHS 7, received 7 inoculations of A strain tumors (PHS 17, 20, 9, 9, 10 and 14). Five tumors developed. Although this mouse had been refractory to PHS 7 for over a month, there remained a tiny palpable nodule, supposedly scar tissue, in the right axilla. Owing to this, no subsequent inoculation was made into this site. Following the second successive inoculation, PHS 7 began to grow and continued to do so. PHS 20 (second inoculation), PHS 9 (third inoculation), PHS 9 (fourth), and PHS 9 (fifth inoculation) also grew, and the mouse was moribund thirty-four days after the inoculations were begun, with five large tumors. This mouse might almost be called susceptible to A tumors, as five out of the seven A tumors inoculated grew, and only two A tumors (PHS 17 and PHS 10) failed to do so.
LITERATURE

Loeb, Leo: Grafting of tissues into nearly related individuals in the rat, and the mode of inheritance of individuality-differentials, J. M. Research 33: 393, 1918.