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PREVALENCE OF POLIOMYELITIS

The poliomyelitis situation has changed but little within the past week. For the week ended August 12, 261 new cases were reported, as compared with 210 for the preceding week. While this indicates an increase of 24 percent over the preceding week, this is not disproportionate to the normal increase expected according to the 5-year median figures.

The 4 States reporting an abnormal number of cases for the week were as follows: Michigan, 78 cases; California, 51; Minnesota, 23; and South Carolina, 14. These States reported 166 cases, or 63 percent of the Nation's total for the current week. Detroit reported 65 cases for the week ended August 12, as compared with 37 for the week ended August 5 and with 31 cases for the week ended July 29. An analysis of cases reported in Detroit shows that, according to actual time of onset, there were only 25 cases for the current week as compared with 45 and 35 cases for the 2 preceding weeks. The additional cases included in the report for the current week represent delayed reports of cases that developed some time before actual report.

TREATMENT OF INDUCED MALARIA IN NEGRO PARETICS WITH MAPHARSEN AND TRYPARSAMIDE[1]

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Arsenicals have been tried from time to time in the treatment of malaria. According to various reports, such preparations as arsphenamine (salvarsan) and neoarsphenamine (neosalvarsan) relieve the symptoms of tertian malaria temporarily, but relapses are common. Against quartan (*Plasmodium malariae*) and estivoautumnal (*P. falciparum*) malaria these arsenicals have been less successful and very little benefit has usually attended their use.

[1] Contribution from the Williams Malaria Research Laboratory for Field Investigations of Malaria, of the National Institute of Health, U. S. Public Health Service, and the South Carolina State Hospital, Columbia, S. C.

Mapharsen, a trivalent arsenic compound formed by the oxidation of any of the arsphenamines, has recently come into use in the treatment of syphilis. Goldman (*1*), working with both natural and induced tertian malaria (*P. vivax*), used mapharsen to terminate the chills and fever with "strikingly good effect." Nine of his patients received 11, one received 4, and 14 patients received 1 intravenous injection of 0.04 to 0.06 gm. of mapharsen. There were only 2 relapses and both of these occurred after the patients had received only 1 injection of mapharsen. These relapses were subsequently cured by additional injections of mapharsen. Goldman stated that this drug was immeasurably more effective than quinine for the treatment of malaria.

During the past year, at the South Carolina State Hospital, a series of 10 Negro paretics who had been infected for therapeutic purposes with quartan malaria were given mapharsen. Each patient received 0.04 gm. of mapharsen intravenously weekly for a period of 10 weeks. At the same time 0.02 gm. of thiobismol was given. Subsequently, 2 of the 10 patients received a course of tryparsamide.

Twenty-two weeks after the completion of the mapharsen treatment, blood smears from all 10 patients still showed parasites (*P. malariae*), although the patients showed no symptoms of the disease. To test the viability of the parasites, subinoculations were made from 2 of the mapharsen-treated paretics to 2 uninfected persons. Typical symptomatic and parasitic infections with quartan malaria developed in both, which showed that the mapharsen had not affected the viability of the malaria parasites.

Examinations were made of 3 quartan malaria patients who had received tryparsamide in antisyphilitic treatment. One year after the completion of the tryparsamide treatment 2 patients still harbored *P. malariae* in the blood stream. Another patient still had parasites 9 months after treatment.

Another group of 8 patients was started on tryparsamide. Four patients completed the 10-week treatment, and the malaria parasites were continually present. Treatment of the other 4 was interrupted after the fifth week, and all had shown malaria parasites continually. Subinoculation from one of this group, in the fifth week of tryparsamide treatment, resulted in a typical symptomatic and parasitic course of malaria, showing that the parasites were still viable.

DISCUSSION

A drug specific for both syphilis and therapeutic malaria would have obvious advantages in the treatment of neurosyphilis. Mapharsen has been suggested in this capacity by Goldman (*1*) where tertian

malaria (*P. vivax*) is used. However, quartan malaria is being used rather widely in the treatment of paresis because of the several favorable characteristics of this type, such as relative absence of immunity in patients, reliability, and favorable length of the rest periods between paroxysms. Therefore, mapharsen was tried on this type.

In our experience mapharsen did not eradicate the parasites in a single malarial infection, although it relieved the symptoms. Such a condition seems to be undesirable, since malaria carriers who show no symptoms might be paroled from the hospital. The authors know of one instance in which this has happened. In this way foci of infections might be established for a type of malaria which is now rare in the United States. Because of this possibility, mapharsen should not be relied upon to terminate quartan malaria.

Likewise, tryparsamide, either alone or in combination with mapharsen, proved to be ineffectual in eradicating *P. malariae* in 13 cases at this hospital. Therefore, this drug, like mapharsen, should not be used to terminate quartan malaria.

SUMMARY AND CONCLUSIONS

Mapharsen, recently reported to be effective against tertian malaria (*P. vivax*), was tried against quartan malaria (*P. malariae*). Ten Negro paretics in whom malaria was used in antisyphilitic treatment were given mapharsen. Two of the patients also received a course of tryparsamide. These patients still showed parasites in blood smears 22 weeks after completion of the mapharsen treatment. Subinoculations from 2 of the mapharsen-treated paretics resulted in typical malaria infections, thus proving that the parasites were viable.

In 11 Negro paretics, tryparsamide was used against *P. malariae*. The parasites never disappeared from the blood. A subinoculation from the tryparsamide-treated group produced an infection, proving that the parasites were viable.

As these drugs relieved the symptoms without eradicating the infection, it is pointed out that their use might inadvertently result in quartan malaria carriers being released and thus establish foci of infections of a type of malaria now rare in the United States.

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(1) Goldman, D.: The use of mapharsen in the treatment of malaria. Am. J. Med. Sci., **196**: 502-509 (1938).

PULMONARY TUMORS IN MICE[1]

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VI. TIME OF APPEARANCE OF TUMORS INDUCED IN STRAIN A MICE FOLLOWING INJECTION OF 1:2:5:6-DIBENZANTHRACENE OR 20-METHYLCHOLANTHRENE

Investigations reported previously from this laboratory (*1*) have shown that the lungs of strain A mice are more susceptible to the carcinogenic activity of dibenzanthracene [2] than are their subcutaneous tissues. It has been found consistently that, following subcutaneous injection of 0.8 mg. of dibenzanthracene as a lard solution, practically every mouse exhibited lung tumors 3 months later, while the average time of appearance of tumors at the injection site was 6 to 7 months (*6*).

The fact that strain A mice develop pulmonary growths within 3 months after subcutaneous injection of 0.8 mg. of dibenzanthracene dissolved in lard indicates a high degree of uniformity in the latent period of these tumors and presents an excellent opportunity for histological studies of the development of induced tumors. It is apparent that a better understanding of premalignant changes can be derived from a study in which it is known that every animal will develop tumors at approximately the same time. Furthermore, the occurrence of tumors in the lungs following subcutaneous injection obviates traumatic and other changes taking place at the injection site which have no direct bearing upon the induction of tumors.

This paper is a brief description of the results of 9 experiments performed in 1937 to determine the time of appearance of macroscopic lung nodules in strain A mice following the injection of dibenzanthracene or methylcholanthrene. The same procedure was carried out in all the experiments. Beginning 2 weeks after injection 2 or 3 animals were sacrificed each week and examined for the presence of lung nodules; the lungs were fixed and examined microscopically to confirm the macroscopic observations. No efforts were made to study the development of the induced tumors since such studies involve serial sections of the lung tissue, a procedure which could not be attempted at the time. The only outstanding feature of the development of the induced tumors obtained from the study of a considerable number of stained preparations was the absence of any evidence of irritation, as revealed by the lack of inflammatory reaction, in lungs prior to and throughout the early stages of tumor development.

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[1] From the Office of Cancer Investigations, U. S. Public Health Service, Gibbs Memorial Laboratory, Harvard University, Cambridge, Mass.

[2] Throughout this paper the term dibenzanthracene signifies 1:2:5:6-dibenzanthracene and the term methylcholanthrene means 20-methylcholanthrene.

The findings of all 9 experiments have been condensed and are presented in table 1. In the table the results of the weekly examinations are represented as fractions in which the numerators denote the number of mice with macroscopic lung tumors and the denominators the number of mice examined.

TABLE 1.—*Summary of nine experiments to determine the time of appearance of macroscopic lung tumors in strain A mice following injections of dibenzanthracene or methylcholanthrene*

Hydrocarbon used	Route of injection	Amount injected, in mg.	Time, in weeks, for appearance of lung tumors [1]								
			2	3	4	5	6	7	8	9	10
Dibenzanthracene	Subcutaneous	0.8	0/13	0/12	6/20	1/16	8/22	12/20	21/23	9/9	29/29
Do	Intravenous	0.2	0/4	0/4	0/4	1/4	4/4	5/6	4/4	6/6	----
Do	do	0.5 or 1.0	0/5	0/5	3/6	4/5	19/19	2/2	2/2	2/2	2/2
Methylcholanthrene	Subcutaneous	0.8	----	0/4	2/6	1/7	3/6	4/6	5/7	----	----
Do	Intravenous	0.375 to 1.0	0/7	0/7	2/10	5/7	25/25	5/5	----	----	----

[1] Numerators denote number of mice showing lung nodules. Denominators denote number of mice killed.

Following the subcutaneous injection of 0.8 mg. of dibenzanthracene, tumors began to appear 4 weeks after injection and by the eighth week after injection virtually all the animals had lung nodules. In these experiments the carcinogen was injected in a lard solution in doses of 0.2 cc. and 0.4 cc. of the solvent; in a horse-serum dispersion in doses of 0.8 cc. and 2 cc. of horse serum; in 2 cc. of a lard emulsion in water; in 2 cc. of an olive-oil emulsion in water; in 0.4 cc. of a mouse-fat emulsion in water; and in 0.4 cc. of a lard emulsion in serum. Lung tumors appeared at approximately the same time following the use of the different preparations.

Investigations in which the hydrocarbon was injected in different emulsions were performed in collaboration with Dr. Egon Lorenz, who made the preparations. These experiments represent efforts to ascertain whether the preparations exerted any influence upon the time of appearance of induced internal tumors. It is to be noted that lung tumors were induced by the carcinogen injected as a mouse-fat emulsion because Peacock and Beck (*15*) found that 1.0 mg. of 3:4-benzpyrene dissolved in 0.2 cc. of mouse fat induced few tumors in mice at the site of subcutaneous injection. These authors believed that the carcinogen, when dissolved in mouse fat, was absorbed and eliminated before it was able to produce tumors, but experiments performed in this laboratory (*8*) revealed that mouse-fat solutions of dibenzanthracene or methylcholanthrene induced subcutaneous tumors as readily as did lard solutions.

As seen in table 1, 0.2 mg., 0.5 mg., or 1.0 mg. of dibenzanthracene, when injected intravenously, produced lung tumors in practically all the mice within 6 weeks, indicating that intravenous injection of 0.2 mg. or 0.5 mg. of the carcinogen induced lung tumors earlier than did 0.8 mg. when injected subcutaneously.

Table 1 also reveals that 0.8 mg. of methylcholanthrene, injected subcutaneously, and 0.375 mg. to 1.0 mg. of methylcholanthrene, injected intravenously, induced pulmonary tumors at approximately the same time as did similar amounts of dibenzanthracene. Shimkin (*17*) has found multiple lung tumors in strain A mice 4 months after intravenous injection of 0.1 mg. of methylcholanthrene in a horse-serum dispersion.

DISCUSSION

The outcome of this series of investigations permits several conclusions: Strain A mice possess a high degree of susceptibility to the induction of pulmonary tumors by these hydrocarbons; intravenous injection is more efficacious than subcutaneous injection for the induction of pulmonary tumors; and smaller quantities of the hydrocarbons than those used in these studies may be capable of producing pulmonary growths in strain A mice. As mentioned previously, 0.8 mg. of dibenzanthracene in a variety of preparations evoked tumors within 4 to 8 weeks, which suggests the use of smaller amounts of the carcinogen for more precise determinations of the influence of the solvent. Furthermore, the fact that a single intravenous injection of 0.2 mg. of dibenzanthracene or 0.1 mg. of methylcholanthrene is capable of inducing tumors in practically all mice of strain A within a relatively short period of time suggests that smaller amounts may evoke tumors.

The appearance of lung tumors following injection of small amounts of carcinogenic hydrocarbons has some bearing upon the explanation of the occurrence of induced tumors in mice. Two possibilities have received considerable attention (*11*): (1) The carcinogen produces a systemic change resulting in a lowered resistance to tumor development; (2) the carcinogen is absorbed and acts directly on the lung tissues.

The possibility of a systemic change resulting in the appearance of lung tumors in mice may be of more than academic interest, for if the tumors arise because of an altered constitution which is elicited by an agent injected at a site distant from the lungs, it is not impossible that similar conditions may cause tumors in other species.

There are several facts which may be interpreted as evidence that a general lowered resistance is responsible for the occurrence of induced lung tumors in mice. First, the induced and spontaneous tumors in mice of strain A have the same macroscopic and microscopic

structure and both have a tendency to arise just beneath the pleura. Moreover, identical lung tumors occur in strain A mice following injection of dibenzanthracene by the subcutaneous, intravenous, intrapleural, intraperitoneal, or intratracheal routes (*17*), and also following ingestion (*14*). Second, it has been shown (*6*) that different inbred strains of mice exhibit variations in susceptibility to the development of spontaneous lung growths and those strains which have the highest incidence of spontaneous growths are most susceptible to the development of induced tumors. Hence, it may be argued that the carcinogen releases the tendency toward tumor development in strains which already have a genetic make-up conducive to pulmonary tumors.

While it is known that the susceptibility of the lungs of strain A mice to the development of both spontaneous (*10*) and induced (*2*, *5*) tumors is inherited according to genetic principles, nevertheless up to the present time an inbred strain or their hybrids which are completely resistant to the induction of lung tumors by dibenzanthracene has not been found. They have been evoked (*9*) in mice of the C57 black strain, a strain very resistant to the development of spontaneous pulmonary tumors. While it may appear logical to assume that an inherited susceptibility is responsible for the occurrence of induced tumors in strains which are highly susceptible to spontaneous growths, it is not clear how an inherited susceptibility could be responsible for the tumors in strains which are very resistant to spontaneous lung tumors were it the only factor involved in their occurrence. If an altered constitution is the reason for the appearance of the tumors in one strain it should follow that it is also responsible for the same type of tumor in other strains. Hence, it is believed that the genetic constitution of the experimental animals should not be regarded as the only factor involved in the appearance of induced lung tumors. The difference in susceptibility to induced pulmonary tumors, as exhibited by the various strains of mice, is a matter of degree and it is suggested that hereditary factors exert their influence by controlling the degree of susceptibility.

It is difficult to design an experiment capable of elucidating the problem as to whether the carcinogenic action of the hydrocarbons is local in the lungs or whether it brings about a release of inherited tendencies. The results presented here reveal that very small amounts are capable of causing tumors in the lungs of strain A mice, which implies that if the cancer-inducing agent is injected subcutaneously, only a small quantity need be absorbed to act upon the lung tissue and produce tumors. But it can also be interpreted as showing that only small amounts are necessary to alter the constitution of the test animal. The induction of pulmonary tumors in strain A mice by placing a known quantity of dibenzanthracene at a site distant from the lungs and recovery of *all* of the carcinogen at a later date would be

evidence that direct contact of lung tissue with the agent is not essential.

There is experimental evidence suggesting that direct contact of dibenzanthracene with lung cells exerts an influence upon the occurrence of pulmonary tumors in mice. It has been shown that tumors are induced when the hydrocarbon is introduced directly into the lungs. In one experiment (*3*) silk threads were coated with the agent and placed in the lungs of mice; tumors arose around the coated threads. In another series of investigations (*4*), dibenzanthracene was adsorbed onto charcoal and injected intravenously into strain A mice; it localized in the lungs and produced tumors. When charcoal-adsorbed dibenzanthrancene was injected subcutaneously into strain A mice, lung tumors were not induced and it was shown that the charcoal held the carcinogen at the site of injection. Equal quantities of dibenzanthracene (*3*) were injected subcutaneously in lard solutions or in serum dispersions; the latter materials induced fewer tumors at the site of injection but more lung tumors. This indicated that more lung tumors were evoked when the carcinogen was injected in a medium which left the site of injection, thereby offering it better opportunity to come in contact with lung tissues. Finally, it has been shown previously (*7*) and is confirmed in this paper that, so far as the induction of lung tumors is concerned, dibenzanthracene is more efficacious when injected intravenously than subcutaneously. The intravenous route gives the agent ample opportunity for direct action upon the lungs.

Lettinga's publication (*13*) may be regarded as further evidence that lung tumors are evoked by the direct action of the hydrocarbon. When mice were injected subcutaneously with from 0.0125 to 1.0 mg. of dibenzanthracene, they developed subcutaneous tumors and few lung tumors; when they received from 2.5 to 5.0 mg. of the hydrocarbon subcutaneously, they developed subcutaneous tumors and many pulmonary tumors. The findings may be interpreted by assuming that below a certain amount (2.5 mg.) the carcinogen was retained at the injection site or stored within the body, while above this amount the excess overflowed and produced pulmonary growths by acting upon the lung tissue. It could also be assumed, however, that a definite quantity of the agent was essential for lowering the resistance of the mice to such a degree that the inherited tendency could manifest itself. A third possibility is that the experiment determined the relative susceptibility of subcutaneous and lung tissues of the test mice to the carcinogenic activity of dibenzanthracene. Lettinga's animals must have been more resistant to the induction of pulmonary tumors than are mice of strain A, for 2.5 mg. of the subcutaneously injected hydrocarbon were necessary for definite lung-

tumor production in Lettinga's animals, while 0.8 mg. of the hydrocarbon injected subcutaneously induces pulmonary growths in practically every strain A mouse within 10 weeks. A part of the injected hydrocarbon could have been absorbed from the injection site in all of Lettinga's animals but only when 2.5 mg. were injected was a sufficient quantity absorbed to induce pulmonary tumors. This is regarded as additional evidence that dibenzanthracene induces pulmonary tumors in mice by direct contact with lung cells and it also implies that small amounts of dibenzanthracene when injected subcutaneously into strain A mice should induce subcutaneous tumors only. The use of mice more susceptible to the induction of lung tumors than those employed by Lettinga may be desirable for confirmation of the work, as smaller amounts of lard-dibenzanthracene solutions could be injected subcutaneously and would produce lung tumors; in this laboratory the large amounts of lard-dibenzanthracene solutions (5 mg. in 2.5 cc. of lard) used by Lettinga for subcutaneous injection produce severe ulceration at the injection site in all strains of mice.

From the foregoing discussion it is evident that the direct action of dibenzanthracene upon pulmonary tissues plays some role in the development of induced lung tumors in mice. It is agreed that hereditary factors also play an important part in their appearance; indeed, the importance of a special organ susceptibility cannot be overemphasized. But it is essential to recall (*6*) that the genetic constitution of the experimental animal is of importance in all phases of experimental cancer; inbred strains of mice vary in their susceptibilities to the development of spontaneous tumors of different organs, in their abilities to overcome the growth energies of transplantable tumors, and in their responses to the induction of local tumors by carcinogenic agents. It is well known that environmental conditions exert a decided influence upon the occurrence of certain types of tumors in strains possessing a tendency to develop them spontaneously. For example, male mice belonging to a strain in which the females are highly susceptible to spontaneous breast cancer respond to injections of estrogens (*12*) by developing breast cancer, while males derived from strains in which the females exhibit a low incidence of this type of cancer are, as a rule, much more resistant to the action of estrogens.

In the production of tumors at the injection site by carcinogenic agents as well as in the induction of tumors in organs removed from the site of administration (mammary tumors induced by estrogens and liver tumors induced by 2-amino-5-azotoluene) the genetic constitution of the experimental animals is generally accepted as of prime importance, but none of these tumors is assumed to result from a

release of inherited tendency alone. To assume, therefore, that the induction of pulmonary tumors in mice is caused only by a general lowering of resistance implies that this type of tumor is unique. It is believed that experimental evidence available up to the present time does not justify this view and it is suggested that, until experimental evidence to the contrary is presented, the induction of lung tumors in mice should be regarded as the result of the action of a carcinogenic agent upon a highly susceptible tissue.

In the foregoing discussion two factors (heredity and organ susceptibility) have been considered to be involved in the induction of pulmonary tumors, but other possibilities should receive attention. It can be postulated that an unknown agent normally present within the body of mice is responsible for the occurrence of spontaneous lung tumors and that the cancer-inducing hydrocarbons, or derivatives, hasten the appearance of tumors by supplementing its activity. This might imply that the agent and the hydrocarbons have a chemical relationship. There is also the possibility that the hydrocarbons enable the body to produce more of the agent in a manner similar to the action of the bacteriophage, which increases in quantity or in degree of activity when brought in contact with bacteria. Again, the carcinogens may cause the elimination or neutralization of a substance in the body which normally holds the unknown agent in abeyance; the agent would then be free to act upon highly susceptible lung tissues. In this connection White and White (*18*) have published results of methylcholanthrene feeding to rats and conclude that "methylcholanthrene may produce a deficiency in the sulfur-containing amino acids, possibly by virtue of the involvement of these amino acids in the detoxication of the hydrocarbon."

Finally, the hydrocarbons, or their derivatives, may act directly upon the lung cells and render them more susceptible to the cancer-inducing power of the unknown agent. This speculation is based upon the work of Rous and Kidd (*16*) who found that when the Shope papilloma virus is injected intravenously into rabbits whose ears have been painted with tar, the virus localizes in the tarred area and malignant growths appear within a much shorter period of time than when the neoplasms are produced by tar-painting alone. Irritants or trauma have long been recognized as important factors in the localization of viruses within susceptible tissues; tumors usually arise at the point of puncture when a filtrate of the chicken tumor agent is injected intravenously. These observations suggest that the hydrocarbon may act upon the lung tissue in a manner similar to that of tar in the experiment of Rous and Kidd by preparing a fertile soil within the lungs of mice upon which an unknown agent could readily set up a series of changes which eventuate in malignancy.

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VII. FURTHER STUDIES ON THE SERIAL TRANSMISSION OF LUNG TUMORS OCCURRING IN INBRED MICE

In an earlier publication (*1*) serial passages of 7 pulmonary tumors arising in mice following parenteral introduction of 1:2:5:6-dibenzanthracene were described. All the tumors occurred in mice of strain A and all implantations were made into the subcutaneous tissues of other members of the same strain. In three instances the primary tumors were adenomatous in structure, but in the succeeding passages spindle cells became predominant. Interest was aroused in the problem because all three tumors undergoing the pronounced change in histologic appearance were induced tumors, while one tumor (lung tumor F) which failed to assume a spindle cell appearance was, in all probability, a spontaneous growth. The question arose as to whether the induced tumors only became sarcomatous upon serial transplantation. Consequently, a number of other spontaneous or induced pulmo-

nary tumors have been carried through serial passages by subcutaneous inoculation in order to determine (*a*) whether spontaneous pulmonary tumors arising in strain A mice exhibit the change when carried through animal passages, and (*b*) whether the phenomenon occurs when induced lung tumors arising in other strains of mice are transplanted into members of the same strain. In other words, is the change a unique characteristic of pulmonary tumors arising in strain A mice, or is it characteristic of transplanted pulmonary tumors in inbred mice in general?

EXPERIMENTAL

The usual trocar technique was employed for all implantations, which were made subcutaneously in the right axillary region. A tumor arising in a certain strain was always transplanted into individuals of the same strain. Mice of strains A, C, and C_3H were used since these strains were known (*2, 3*) to be susceptible to both spontaneous and induced pulmonary growths. Material for histologic study was obtained from every transplanted tumor. All histologic preparations were examined by Pathologist H. L. Stewart of this laboratory.

A detailed account of the procedure by which the tumors were induced and of the results of serial transmission was presented in a previous report (*1*). It is felt that a similar description of all 13 tumors used in this study would be unnecessary. The pertinent data are presented in table 1.

TABLE 1.—*Summary of 20 pulmonary tumors arising in inbred mice and carried through serial passages in normal mice*

Lung tumor designation	Strain of mice in which the tumor originated	Spontaneous or induced by dibenzanthracene	Histological appearance of original tumor in lung	Number of serial passages in subcutaneous tissues	Histological appearance of last passage tumor in subcutaneous tissue
A	A	Induced	Not available	22	Spindle cell.
B	A	do	do	15	Do.
C	A	do	Adenomatous tumor	12	Do.
D	A	do	do	10	Do.
F	A	?	do	49	Atypical.
G	A	Induced	do	17	Do.
H	A	do	do	10	Glandular.
I	A	Spontaneous	do	11	Atypical.
L	A	do	do	8	Spindle cell.
M	A	do	do	4	Glandular.
N	C	Induced	do	2	Do.
O	C	do	do	6	Spindle cell.
P	A	Spontaneous	do	7	Atypical.
R	C_3H	Induced	do	6	Do.
S	C	do	do	6	Glandular.
T	A	Spontaneous	do	6	Atypical.
U	C	Induced	do	2	Glandular.
W	C	do	do	6	Atypical.
X	C	do	do	6	Glandular.
Z	C_3H	do	do	6	Spindle cell.

The table includes records of all serial transplantations of spontaneous or induced tumors carried out in this laboratory up to the present

time with the exception of one tumor (lung tumor J) which was induced by placing the carcinogen in direct contact with lung tissues. The designation of each tumor is listed in the first column of the table and the strain of mice in which it arose is indicated in the second column. Twelve tumors were found in strain A mice, 6 in strain C mice, and 2 in strain C_3H animals.

The third column of the table indicates whether the tumors were induced or of spontaneous origin. Of the 12 strain A tumors 5 arose spontaneously and 6 were induced. Lung tumor F is considered questionable since it was found in a 20-month old strain A mouse which had received subcutaneously a cholesterol pellet containing 0.001 percent 1:2:5:6-dibenzanthracene. Since the majority of strain A mice develop spontaneous pulmonary tumors at an average age of 18 months (*4*) this was probably a spontaneous tumor, but the presence of the hydrocarbon in the animal cannot be ignored. All tumors arising in strain C or strain C_3H mice were induced by parenteral injection of dibenzanthracene.

The histologic diagnoses of the original pulmonary tumors are shown in the fourth column of the table. Stained preparations of the original tumors A and B were not available. The remainder were all designated as adenomatous tumors, consisting of cuboidal and columnar cells growing chiefly in papillary and adenomatous arrangement (figs. 1 and 2). The histologic structure of spontaneous pulmonary tumors in mice has been described by Tyzzer (*7*), and the appearance of the induced growths is similar to that of the spontaneous tumors.

Some of the induced pulmonary tumors arose in mice which had received a subcutaneous injection of the carcinogen and were found after a tumor had appeared at the injection site. In such instances the subcutaneous tumor was examined microscopically to rule out the possibility that the lung tumors were metastases. All the subcutaneous growths were spindle cell sarcomas with the exception of one occurring in a male strain C mouse from which lung tumor W was obtained; the subcutaneous tumor in this animal was diagnosed as an adenosquamous cell carcinoma, possibly of mammary gland origin. While the microscopic appearance of the original nodule from which lung tumor W was obtained was a typical adenomatous tumor, nevertheless the possibility of a metastatic nodule cannot be completely eliminated.

The number of serial passages for each tumor is shown in the fifth column of the table. It was intended to carry each tumor through at least 6 animal passages but 3 of the tumors (M, N, and U) were discontinued after 4, 2, and 2 passages, respectively, because the implants failed to show evidence of growth 3 months after subcutaneous inoculation. This does not mean that the tumors failed to propagate themselves in the subcutaneous tissues, for growth might have been

noted if the animals had been kept under observation for longer periods of time. All the tumors which were propagated successfully through more than 4 passages grew slowly in earlier passages and increased in growth rate in later passages. In this respect they resembled tumors A, B, C, D, and F, which have been described in detail in an earlier report (*1*).

In the last column of the table the histologic diagnosis of the final passage of each tumor is given. Tumors failing to exhibit any pronounced change in histologic structure were designated as glandular tumors; these continued to reproduce the typical glandular structure with cuboidal and columnar cells as found in the primary tumors (fig. 5). Lung tumors H, M, N, S, U, and X were included in this group.

Seven tumors (F, G, I, P, R, T, and W) are listed as atypical tumors. These tumors did not reproduce the glandular structure of the original tumors but revealed a definite change in structural arrangement (fig. 4). The tumor cells grew solidly in the form of large masses, nests, and thin strands; some tended to be round or oval, and a few were polyhedral in shape. The nests and strands were separated, in some instances, by spindle cells, but the majority of the tumor cells resembled epithelial cells.

The seven remaining tumors (A, B, C, D, L, O, and Z) consisted of spindle cells arranged in interlacing bundles running in different directions and contained no recognizable glandular elements. The blood vessels were slitlike and immature. These tumors resembled spindle cell sarcomas (fig. 3).

DISCUSSION

In the 20 pulmonary tumors of mice studied, 6 were adenomatous in structure in the primary growth or first passage, but upon serial passages in the subcutaneous tissues of other mice became predominantly spindle cell in appearance. Of the tumors exhibiting the pronounced structural change, 1 arose spontaneously in a mouse of strain A, 3 were induced with dibenzanthracene in strain A mice, 1 was induced

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EXPLANATION OF PHOTOMICROGRAPHS

The photographs are presented to illustrate the morphology of the growths obtained when primary lung tumors underwent serial passages in the subcutaneous tissues of normal mice. Figures 1 and 2 illustrate a typical primary lung tumor and figure 3 shows the last passage of this tumor which has changed to a spindle cell growth. Figures 4 and 5 are characteristic of 2 other types of growth obtained upon serial passage of tumors identical in histologic structure to that shown in figures 1 and 2. In figure 4 the glandular arrangement has been lost although the individual cells maintain the same appearance as in the original tumor. In figure 5 the glandular structure has remained unchanged.

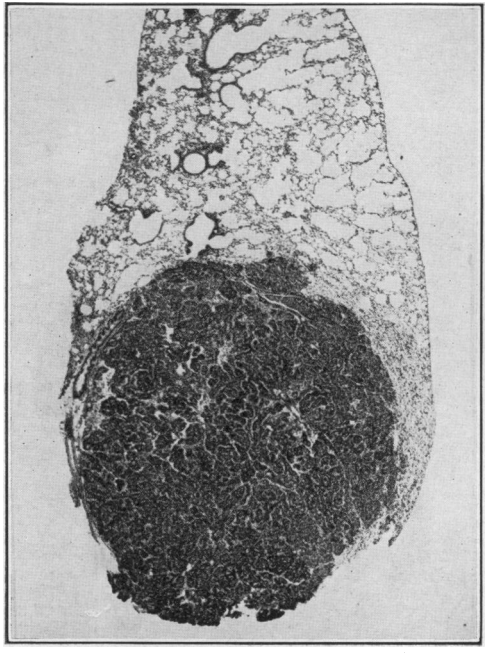

FIGURE 1.—Lung tumor L. Primary growth. (× 23.)

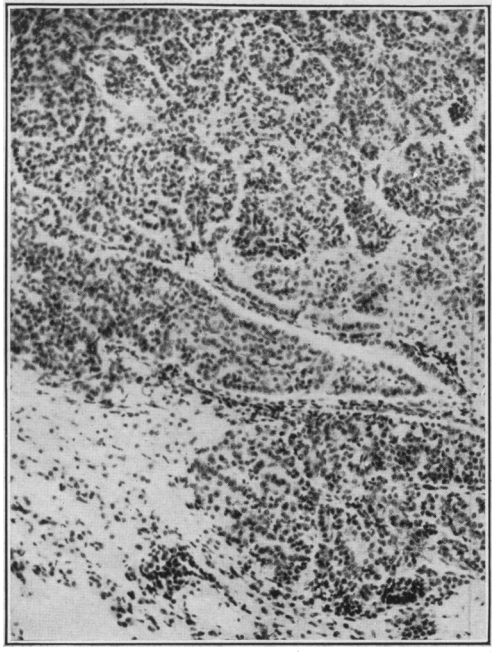

FIGURE 2.—Lung tumor L. Primary growth. (× 125.)

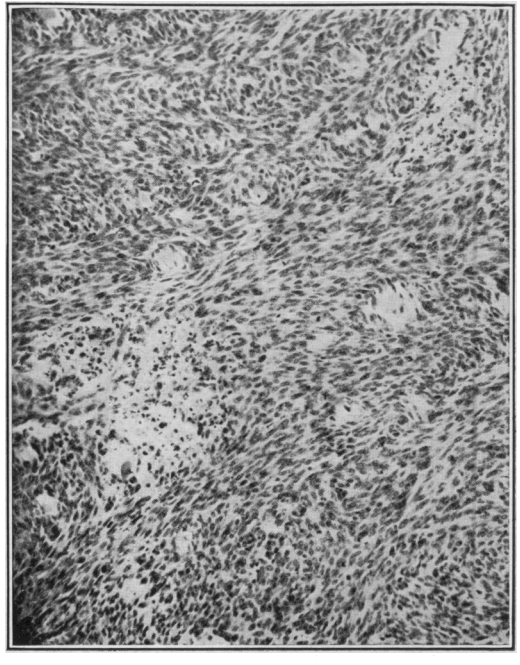

FIGURE 3.—Lung tumor L. Eighth passage. (× 125.)

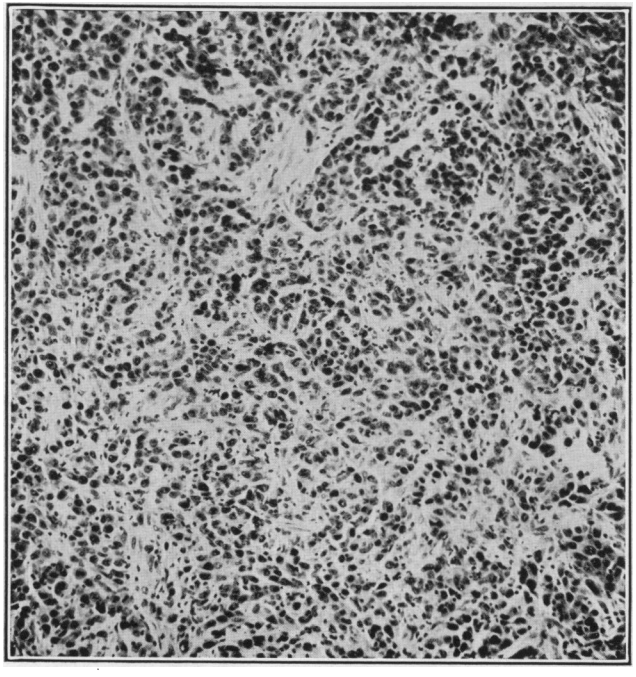

FIGURE 4.—Lung tumor F. Forty-ninth passage. (× 125.)

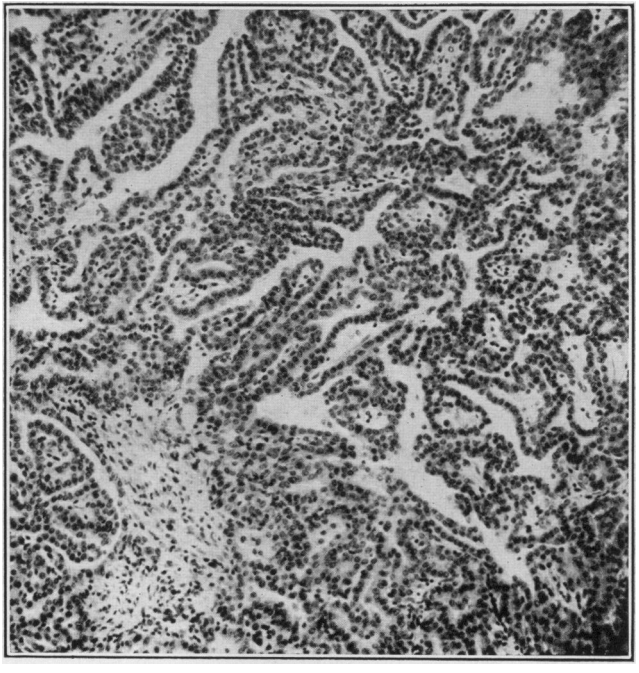

FIGURE 5.—Lung tumor H. Tenth passage. (× 125.)

in a strain C mouse, and 1 was induced in a mouse of strain C_3H. It may be concluded, therefore, that the phenomenon is not restricted to induced tumors only or to tumors induced in mice of strain A. Whether this transition is limited to pulmonary tumors of mice or to pulmonary tumors arising in highly inbred strains of mice is unknown. Gorer (*6*) records one spontaneous tumor arising in a strain A mouse which "appeared to be a typical mammary carcinoma" macroscopically and became sarcomatous upon transplantation. It is possible that a thorough study of other types of tumors appearing in highly inbred mice may also reveal the phenomenon.

Several explanations may be postulated for the change in appearance of lung tumors during animal passages: (1) The lung tumors arise as mixed tumors and the sarcoma cells overgrow the carcinoma cells in the subcutaneous tissues of the host; (2) the stroma cells supplied by the animal bearing the transplanted tumor become sarcomatous; (3) the malignant epithelial cells change in appearance; (4) the primary tumors are not epithelial tumors. The investigations recorded here fail to offer any conclusive evidences favoring any of the above-mentioned possibilities. Campbell (*5*) reported 13 mice, 7 of which had primary pulmonary tumors containing spindle cells and 6 of which had primary lung tumors in which "there was evidence of change to this type of cell." Such observations suggest that some tumors may arise as mixed tumors or that the spindle cells are a transition from the carcinoma cells. Histologic examinations of the primary lung tumors used in this investigation have not revealed any definite evidence of spindle cells, but serial sections of the original tumors have not been made. Stained preparations of some transplants show definite stretching of carcinoma cells, but this also occurred in tumors which did not assume a spindle cell structure in subsequent passages.

The stroma of the majority of the transplants contained some spindle cells which appeared to have malignant characteristics, but similar cells were also seen in tumors which failed to change into spindle cell growths. Indeed, they were observed in tumors which continued to reproduce the structure of the original lung tumor. The possibility that the primary tumors consist of sarcoma cells cannot be evaluated until a better knowledge of the embryological origin of the alveolar cells of the lung is available. Certainly the histologic appearance of any of the original lung tumors used in this study does not permit a diagnosis of sarcoma.

SUMMARY

Twenty pulmonary tumors arising in inbred mice were used in this investigation. Five tumors arose spontaneously in strain A mice while 6 were induced in strain A mice, 6 were induced in strain C mice

and 2 were induced in mice of strain C_3H by parenteral injection of 1:2:5:6-dibenzanthracene. One tumor found in a strain A mouse could not be classified definitely as spontaneous or induced. The tumors have undergone from 2 to 49 serial passages in the subcutaneous tissues of normal mice of the strain in which they originated. Histologic examination revealed that 18 of the primary lung tumors were of an adenomatous structure. During animal passages 6 tumors retained the histologic structure of the original tumor, 7 lost the structure of the original tumor to a considerable extent, while 5 changed into spindle cell tumors.

Of the 5 tumors which became spindle cell in appearance, 1 arose spontaneously in a strain A mouse, 2 were induced in strain A mice, 1 was induced in a strain C mouse, and one was induced in a strain C_3H mouse. It is concluded that both spontaneous and induced tumors exhibit the phenomenon and that the change is not limited to pulmonary tumors occurring in any particular strain of mice.

The investigation does not offer any explanation for the pronounced change in histologic structure of some lung tumors during serial passages in the subcutaneous tissues of normal mice.

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VIII. THE INDUCTION OF PULMONARY TUMORS IN MICE OF STRAINS D, M, C57 BROWN, AND C57 BLACK BY 1:2:5:6-DIBENZANTHRACENE

The induction of pulmonary growths in mice of strain A by parenteral administration of a carcinogenic agent might be expected because of the frequent occurrence of spontaneous lung tumors (*8*) in this strain. Furthermore, a review of the literature reveals (*1*) that virtually all investigators who report the induction of pulmonary tumors in mice by tar-painting or by injection of carcinogenic hydrocarbons have also found spontaneous growths in the lungs of control mice belonging to the stocks in which induced tumors occurred. Previous work (*4*) shows that strains of mice exhibit pronounced

variations in susceptibility to induced lung tumors and that those strains which develop the most spontaneous pulmonary tumors are the most susceptible to induced growths. The question arises whether it is possible to induce lung tumors in inbred mice belonging to strains which are regarded as highly resistant to the appearance of spontaneous pulmonary tumors. The present report consists of brief descriptions of five experiments performed to test this possibility.

EXPERIMENTAL ANIMALS

Few observations are available concerning strains of mice with a low incidence of spontaneous lung tumors. Mice of strains C57 black, strain D, strain M (leaden), and strain C57 brown were used as the resistant lines. According to Bittner and Little (*7*), as well as Bittner (*8*), the C57 black mice have an incidence of less than 1.0 percent spontaneous pulmonary tumors, while Cloudman, Bittner, and Little, in a joint publication (*9*), report 0.0 percent incidence for this strain. Bittner (*5*) did not observe any spontaneous pulmonary tumors in strain D mice and, according to Bittner (*6*), Murray did not observe them in his (Murray's) line of strain D animals. Mice of strains M (leaden) and C57 brown were used because it is believed they are related to the C57 black strain.

The horse- and dog-serum dispersions of dibenzanthracene [1] employed in the experiments were prepared by Dr. Egon Lorenz according to a technique reported elsewhere (*10*).

EXPERIMENTAL

Experiment 1.—On October 28, 1936, 26 strain A male and 20 strain D female mice, 3 months old, each received an intravenous injection of 0.5 mg. of dibenzanthracene in 0.5 cc. of horse serum; 2 days later each received another intravenous injection of 0.4 mg. of the hydrocarbon in 0.4 cc. of horse serum, making a total of 0.9 mg. of the carcinogen for each animal. The purpose of the experiment was to determine the susceptibility of the 2 strains to the induction of pulmonary tumors.

Between 13 and 45 weeks following injections the strain A mice were killed and all had multiple lung nodules. Four strain D mice were sacrificed 18 weeks after injection and all were tumor free. Four more were killed 26 weeks following injection; 3 had single lung tumors and one was negative for tumor. Four more were sacrificed 39 weeks after injection and all were free from tumor. Six came to autopsy 45 weeks after injection; 2 were normal and 4 had large single pulmonary tumors.

[1] 1:2:5:6-Dibenzanthracene is referred to as dibenzanthracene throughout this paper.

The experiment demonstrates (*a*) that strain A mice are more susceptible to induced lung tumors than are mice of strain D, and (*b*) that pulmonary tumors were induced in strain D animals.

Experiment 2.—It has been shown (*2*) that subcutaneous injection of a dog-serum dispersion of dibenzanthracene is very effective for the induction of pulmonary tumors in mice. To determine the susceptibility of strains C57 brown and C57 black mice to pulmonary tumors induced by subcutaneous injection of the hydrocarbon, 3-month old female animals of each strain were injected subcutaneously in the right axilla with 0.3 mg. of dibenzanthracene in 1 cc. of dog serum on December 21, 1936; the injection was repeated 1 week later. Thus, each animal received 0.6 mg. of the carcinogen. Nine strain C57 brown and 10 C57 black mice served as test animals. The mice were autopsied when tumors appeared at the site of injection or when they died from other causes.

Of the 9 C57 brown mice, 5 had primary pulmonary tumors; 2 of the mice came to autopsy 46 weeks, one 49 weeks, and two 57 weeks after injection. Two of the C57 black mice necropsied 52 weeks after injection had primary pulmonary tumors.

The results indicate that pulmonary tumors arose in mice of strains C57 black and C57 brown after subcutaneous injection of 0.6 mg. dibenzanthracene.

Experiment 3.—It was shown in previous investigations (*3*) that lung tumors are induced in strain A mice by intravenous injection of charcoal-adsorbed dibenzanthracene. In this experiment mice of various strains were injected intravenously with charcoal-adsorbed dibenzanthracene to determine whether internal tumors could be induced. The carcinogen was adsorbed on charcoal by Dr. Egon Lorenz, as described in the previous publication (*3*). Fifty mg. of dibenzanthracene were adsorbed on 100 mg. of charcoal, which was then added to 50 cc. of sterile physiological saline, and 0.5 cc. of the suspension was injected intravenously into 3-month old female mice on January 7, 1938; each mouse received approximately 0.5 mg. of the carcinogen. The experimental animals consisted of 5 strain A, 10 strain C_3H, 12 strain C57 brown, 11 strain D, 13 strain C57 black, 12 strain C, and 8 strain M mice.

Twenty-six weeks after injection all the mice were alive. Between 26 and 52 weeks following injection 8 strain C_3H mice developed spontaneous breast tumor and were sacrificed; 6 strain C57 brown, all 11 strain D, 3 strain C57 black, 5 strain C, and 1 strain A died or were killed and all were free from lung tumor. Charcoal was present in the lungs of all these mice and stained preparations of the livers, kidneys, and spleens of some mice contained considerable amounts of charcoal. All the strain D mice had succumbed by the thirty-sixth week after injection.

One year after injection the surviving mice (2 strain C_3H, 6 C57 brown, 10 C57 black, 8 M, 7 C, and 4 A) were sacrificed. One strain C_3H mouse had a single pulmonary tumor, 1 strain C57 brown mouse had one lung tumor and 1 had 2 lung tumors, while all 4 strain A and all 7 strain C mice had lung tumors. All the other mice were tumor free, although charcoal was observed in their lungs.

In this experiment charcoal-adsorbed dibenzanthracene induced pulmonary tumors in mice of strains A and C, and perhaps in strain C57 brown, but not in mice of strains D, C57 black, or M.

Experiment 4.—Hybrid mice derived by crossing strains C57 black and D served as test animals. On June 23, 1937, strain C57 black females were mated to strain D males. The young were born between July 14 and August 12 and all were of black coat color. On October 6, 1937, 10 of the hybrids each received an intravenous injection of 1 mg. of dibenzanthracene dispersed in 1 cc. of horse serum, and 13 litter mate controls each received an intravenous injection of 1 cc. of horse serum. All the mice were kept for 9 months after injection, when they were sacrificed. Of the dibenzanthracene-injected mice 9 had from 2 to 6 pulmonary tumors in each pair of lungs and one was negative for lung tumor; the controls were free from pulmonary growths.

The results show that 1 mg. of the carcinogen, when injected intravenously, induced pulmonary tumors in the hybrid mice within 9 months after injection. Since the hybrids were derived from strains regarded as resistant to spontaneous pulmonary tumors they are included in this report as additional evidence that pulmonary tumors can be induced in mice which are resistant to the development of spontaneous lung growths.

Experiment 5.—This experiment was performed to ascertain whether intravenous injection of dibenzanthracene would induce lung tumors in strain C57 black mice. Fifteen female mice approximately 5 months of age were used. Eight were given an intravenous injection of 0.5 mg. of dibenzanthracene dispersed in 0.5 cc. of horse serum, while the remaining 7 were given 0.5 cc. of horse serum intravenously and served as controls.

Two of the dibenzanthracene-injected animals were sacrificed 28 weeks after injection and both were free from tumor. One was killed 36 weeks after injection and 2 lung nodules were found in the lungs. One died 1 week later and was too badly decomposed for autopsy records. Thirty-eight weeks after injection all surviving mice were killed. Of the 4 dibenzanthracene-injected mice, 1 was negative for tumor, 2 had single lung tumors, and 1 had 3 lung tumors. None of the 7 horse-serum-injected controls had a pulmonary tumor.

The results show that lung tumors were induced in mice of strain C57 black within 9 months after intravenous injection of 0.5 mg. of dibenzanthracene dispersed in horse serum.

DISCUSSION

The object of the investigation was to determine whether pulmonary tumors can be induced by dibenzanthracene in strains of mice which are highly resistant to spontaneous lung tumors, and the results show that such tumors can be induced in these strains. The findings do not reveal the relative susceptibilities of the four strains to induced pulmonary growths but do suggest that the intravenous injection of a definite amount of a carcinogenic hydrocarbon may yield information along these lines.

The production of pulmonary tumors in all strains of mice tested up to the present time is in harmony with the results (*4*) obtained when dibenzanthracene was injected subcutaneously into mice, for the carcinogen produced subcutaneous tumors in all strains. The strains vary in their susceptibilities to both types of induced tumors and the variation in susceptibility is determined by their genetic constitutions. Hence, it is again suggested that hereditary factors play an important part in the induction of tumors in mice by influencing the degree of susceptibility.

CONCLUSION

Parenteral administration of 1:2:5:6-dibenzanthracene induced pulmonary tumors in mice of strains D, M, C57 brown, and C57 black, and hybrids derived from the D and C57 black strains. These strains are highly resistant to the development of spontaneous pulmonary tumors.

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IX. THE INDUCTION OF PULMONARY TUMORS IN STRAIN A MICE BY INJECTION OF 2-AMINO-5-AZOTOLUENE OR 3:4:5:6-DIBENZCARBAZOLE

Pulmonary tumors have been induced in mice by the injection of carcinogenic hydrocarbons (*1*) and by skin-painting with coal tar (*7*), but the isolation of 3:4-benzpyrene from coal tar (*5*) indicates that this hydrocarbon may be the active ingredient responsible for tar-induced tumors. The object of this communication is to report the induction of pulmonary tumors in mice by two compounds which are not hydrocarbons, namely, 2-amino-5-azotoluene and 3:4:5:6-dibenzcarbazole.

2-AMINO-5-AZOTOLUENE

This compound produces malignant changes in the livers of experimental animals when fed (*6*) or injected (*8*) subcutaneously, but up to the present time has not induced tumors at the injection site. Shear (*8*) and Kinosita (*6*) have reviewed the work leading up to and following the discovery of the cancer-inducing power of 2-amino-5-azotoluene. According to Kinosita, Maruya observed metaplasia of the bronchial epithelium of rats following administration of the compound but an increase in the incidence of lung tumors in mice is not recorded.

Two experiments have been performed in which 2-amino-5-azotoluene was injected subcutaneously in the right axillary region of mice. In both experiments the compound was injected according to Shear's (*8*) technique; it was moistened with glycerol and injected by means of a trocar. The 2-amino-5-azotoluene was procured from the Eastman Kodak Co. and was used without purification.

Experiment 1.—Strain A male mice 2½ months of age served as test animals. Injections were begun during October 1937 when 14 mice each received 10 mg. of the compound. The injections were repeated at intervals of approximately one month until a total of 11 injections, or 110 mg., had been given. Three mice were sacrificed every 3 months to determine the extent of liver damage and the occurrence of internal tumors. The number of mice in which pulmonary tumors arose and the amount of compound injected are shown in table 1.

TABLE 1.—*Experiment 1. The occurrence of pulmonary tumors in strain A mice following subcutaneous injections of 2-amino-5-azotoluene*

Number of mice necropsied	Number of mice developing lung tumors	Time after first injection, in months	Amount of compound injected (mg.)	Number of mice necropsied	Number of mice developing lung tumors	Time after first injection, in months	Amount of compound injected (mg.)
1	0	2.8	20	1	0	8.7	90
8	2	3.1	30	3	3	9.1	90
3	3	6.1	60	2	2	12.0	110
1	1	7.6	80				

It is seen that of 14 strain A mice coming to autopsy between 3 and 12 months after the first injection, 11, or 78 percent, developed primary pulmonary tumors. Furthermore, the number of macroscopic tumors in each pair of positive lungs increased as the experiment progressed, i. e. each of the mice sacrificed 3.1 months after the first injection had 2 lung tumors while each of the last 2 mice killed 9 months later had 12 lung tumors. The presence of multiple tumors in the majority of the mice, together with the age of the animals, is evidence that the tumors were not spontaneous in origin.

Experiment 2.—This experiment was also begun during October 1937 when each mouse received a subcutaneous injection of 10 mg. of the compound. As in the preceding experiment the injections were repeated at monthly intervals until a total of 11 injections had been given. There were 20 strain I, 10 strain C_3H, 15 strain Y, 14 strain C, and 10 strain A mice used, all of which are susceptible to the induction of lung tumors (*2*) by carcinogenic hydrocarbons. Mice of strains A and C were 3 months old and the remaining animals 6 weeks old. The experiment was terminated one year after the time of the first injection, when all surviving mice were sacrificed.

Eighteen of the strain I mice, 2 of which had pulmonary tumors, lived until the conclusion of the experiment. Eight strain Y animals survived until approximately 11 months after the beginning of the experiment and 4 until the conclusion; 1 had a single pulmonary tumor. Nine strain C_3H mice lived throughout the experiment; all were lung-tumor free when necropsied.

The results of the injection of strain A and C mice are presented in table 2.

In table 2 it is seen that pulmonary tumors arose in strain A and strain C mice following injection of the compound. One tumor, which was found in a strain C mouse 11.9 months after the beginning of the experiment, was 9 mm. in diameter. This tumor was transplanted subcutaneously into other strain C mice and was carried through 6 serial passages.

TABLE 2.—*Experiment 2. The occurrence of pulmonary tumors in mice of strains A and C following subcutaneous injections of 2-amino-5-azotoluene*

Strain A		Strain C		Time after first injection, in months	Amount of compound injected (mg.)
Number of mice necropsied	Number of mice developing lung tumors	Number of mice necropsied	Number of mice developing lung tumors		
1	0			4.3	40
1	0			5.5	50
		1	0	8.7	80
1	1			8.7	80
1	1			9.7	90
1	0			9.9	100
		1	0	9.9	100
5	5			11.2	110
		1	1	11.8	110
		5	5	11.9	110
		6	6	12.0	110

Mice of strains A or C are more susceptible than those of strains I, C_3H, or Y to the induction of lung tumors (*2*) by 1:2:5:6-dibenzanthracene, and the results of experiment 2 suggest that the same order of susceptibility may also hold for tumors induced by this lot of 2-amino-5-azotoluene.

Attention is directed to the fact that the 2-amino-5-azotoluene used in both the experiments was a commercial preparation and the pulmonary tumors may have been induced by an impurity. The problem is receiving further consideration.

Other lesions encountered in the mice of experiments 1 and 2 following injection of the compound will be presented in a future communication; only pulmonary growths are recorded here.

3:4:5:6-DIBENZCARBAZOLE

This compound was found to be carcinogenic for mice by Boyland and Brues (*4*) who record that it evoked tumors at the site of administration and also produced hepatoma in mice. Their results have been confirmed by Strong, Smith, and Gardner (*9*). The occurrence of pulmonary tumors in mice treated with 3:4:5:6-dibenzcarbazole was not mentioned by either group of investigators. The compound used in the following experiment was obtained through the kindness of Dr. G. M. Smith of the Yale University School of Medicine.

Experiment 3.—Twenty strain A female mice, all of which were 3 months old, were used. On December 22, 1938, each received a single subcutaneous injection in the right axilla of 0.2 mg. of 3:4:5:6-dibenzcarbazole dissolved in 0.2 cc. of lard.

One mouse died 3.2 months after injection and was free from tumor. The 19 remaining mice were kept for 4.2 months, when all were sac-

rificed and necropsied. The occurrence of pulmonary tumors in these mice were as follows:

Four had no pulmonary tumor.
Four had one pulmonary tumor each.
Four had two pulmonary tumors each.
Five had three pulmonary tumors each.
Two had four pulmonary tumors each.

The mice were 7.2 months of age when killed and it is seen that 15, or 78 percent, had pulmonary tumors. This incidence is considerably higher than found in normal strain A mice of the same age and, in addition, 11 animals had more than a single macroscopic tumor within their lungs. Hence, it may be concluded that 3:4:5:6-dibenzcarbazole induced pulmonary tumors in the strain A female mice of this experiment.

DISCUSSION

Carcinogenic hydrocarbons produce tumors at the site of administration (*5*) and some, at least, are also able to induce pulmonary tumors in mice (*2*) when injected at a site distant from the lungs. There is in addition some evidence that 1:2:5:6-dibenzanthracene and 20-methylcholanthrene produce hepatoma (*3*) when administered to susceptible mice. Likewise, 3:4:5:6-dibenzcarbazole induces sarcoma in mice when injected subcutaneously and epithelioma when painted on the skin, but it is of special interest that this compound also induces hepatoma when injected subcutaneously or when painted on the skin. The feeding or injection of 2-amino-5-azotoluene produces hepatoma in mice but, in contrast to the hydrocarbons and 3:4:5:6-dibenzcarbazole, it does not induce malignancy at the site of administration.

The results presented here indicate that both 3:4:5:6-dibenzcarbazole and 2-amino-5-azotoluene, when injected subcutaneously into susceptible mice, induce pulmonary tumors. This indicates that pulmonary tumors can be evoked in certain mice by compounds which are not hydrocarbons. Induced tumors occurring after injection of either compound were similar both macroscopically and microscopically to tumors induced by hydrocarbons or arising spontaneously in strain A mice.

The susceptibility of the lungs of strain A mice to the carcinogenic activity of these compounds suggests that other known cancer-inciting agents may evoke similar tumors and that the lungs of this strain may be used as test objects for the presence of two carcinogenic agents which are not hydrocarbons.

CONCLUSION

3:4:5:6-Dibenzcarbazole and 2-amino-5-azotoluene induced pulmonary tumors when injected subcutaneously into strain A mice.

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COURT DECISION ON PUBLIC HEALTH

Statute regarding term of office of State superintendent of public health construed.—(Arizona Supreme Court; *Perkins* v. *Hughes*, 91 P.2d 261; decided June 12, 1939.) Section 2678 of the Arizona Revised Code, 1928, provided as follows:

The governor, the attorney general and the superintendent of public health shall constitute a State board of health. The governor shall be president and the attorney general vice president of such board. The governor shall appoint, by and with the advice and consent of the senate, the superintendent of public health, who shall be a practicing physician of the State, and shall hold his office for two years from the first Tuesday in April succeeding his appointment; he shall be secretary of said board and keep a record of its proceedings and of his own acts as superintendent. The board shall meet not less than once every six months at such place in the State as it may appoint.

The supreme court had presented to it the question of when the term of office of the defendant, who was appointed State superintendent of public health on May 10, 1937, expired. It was decided that the defendant's term of office did not expire until the first Tuesday in April 1940. In its opinion the court said, in part, as follows:

* * * our legislature in 1928 definitely settled the question by deleting the sentence providing for a fixed term of two years for the superintendent of health, and leaving in the section the language which clearly establishes a variable term. * * *

Since the first Tuesday in April succeeding the appointment of defendant was the first Tuesday in April 1938, and since, under the plain and unambiguous language of the present law, he holds office for two years from that date, his term will not expire until the first Tuesday in April 1940, and he is entitled to continue in possession of the office until that date, unless a vacancy occur therein sooner in a manner provided by law.

DEATHS DURING WEEK ENDED JULY 29, 1939

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended July 29, 1939	Corresponding week, 1938
Data from 88 large cities of the United States:		
Total deaths	7,218	7,019
Average for 3 prior years	[1] 7,101	
Total deaths, first 30 weeks of year	258,664	251,255
Deaths under 1 year of age	428	548
Average for 3 prior years	[1] 511	
Deaths under 1 year of age, first 30 weeks of year	15,380	15,948
Data from industrial insurance companies:		
Policies in force	66,918,398	69,014,251
Number of death claims	11,747	12,118
Death claims per 1,000 policies in force, annual rate	9.2	9.2
Death claims per 1,000 policies, first 30 weeks of year, annual rate	10.7	9.5

[1] Data for 86 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders (____ represent no report, with the implication that cases or deaths may have occurred but were not reported to the State health officer.

Cases of certain diseases reported by telegraph by State health officers for the week ended Aug. 5, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median

Division and State	Diphtheria				Influenza				Measles			
	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median
NEW. ENG.												
Maine	0	0	2	1	____	____	2	____	97	16	25	25
New Hampshire	0	0	0	0	____	____	____	____	30	3	1	8
Vermont	0	0	0	0	____	____	____	____	188	14	13	7
Massachusetts	2	2	0	6	____	____	____	____	151	128	81	65
Rhode Island	0	0	1	0	____	____	____	____	137	18	4	7
Connecticut	0	0	1	2	____	____	3	____	65	22	13	18
MID. ATL.												
New York	8	19	15	22	[1]1	[1]2	1	[1]1	94	234	323	261
New Jersey	4	3	9	5	4	3	1	1	19	16	25	73
Pennsylvania	12	24	21	18	____	____	____	____	20	40	117	132
E. NO. CEN.												
Ohio	8	11	6	13	2	3	____	1	16	21	139	79
Indiana	10	7	6	11	____	____	____	5	3	2	1	10
Illinois	4	6	18	20	1	1	3	3	10	15	25	80
Michigan [2]	5	5	12	7	12	11	____	____	44	42	157	68
Wisconsin	0	0	4	2	46	26	10	11	0	0	175	175
W. NO. CEN.												
Minnesota	2	1	2	3	____	____	____	1	29	15	41	20
Iowa	2	1	3	2	____	____	1	1	63	31	21	8
Missouri	1	1	12	10	____	____	23	23	1	1	14	14
North Dakota	15	2	1	3	87	5	1	1	0	0	12	3
South Dakota	8	1	0	0	____	____	____	____	8	1	____	0
Nebraska	8	2	1	1	____	____	5	____	4	1	8	8
Kansas	3	1	2	4	3	1	1	____	11	4	8	8

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Aug. 5, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Diphtheria				Influenza				Measles			
	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median
SO. ATL.												
Delaware	0	0	0	0	----	----	----	----	0	0	----	0
Maryland [3]	3	1	4	4	3	1	2	1	9	3	13	16
Dist. of Col	0	0	4	5	----	----	----	----	40	5	5	3
Virginia	51	27	15	12	30	16	----	----	66	35	46	21
West Virginia	3	1	3	3	16	6	12	14	22	8	6	11
North Carolina [3]	16	11	27	14	----	----	2	----	34	23	100	32
South Carolina [3]	22	8	9	4	183	67	63	45	0	0	9	9
Georgia [3]	27	16	18	11	30	18	----	----	30	18	----	0
Florida [3]	18	6	2	4	3	1	1	----	12	4	----	2
E. SO. CEN.												
Kentucky	19	11	4	3	14	8	3	1	3	2	5	21
Tennessee	7	4	3	7	21	12	6	6	11	6	7	10
Alabama [3]	39	22	19	13	26	15	18	3	2	1	12	3
Mississippi [3]	28	11	11	9	----	----	----	----	----	----	----	----
W. SO. CEN.												
Arkansas	12	5	10	5	12	5	24	4	7	3	18	2
Louisiana [3]	12	5	8	9	22	9	7	10	7	3	1	4
Oklahoma	6	3	3	5	8	4	29	5	6	3	6	3
Texas [3]	17	21	26	31	19	23	74	24	28	34	4	19
MOUNTAIN												
Montana	19	2	0	1	37	4	----	----	112	12	36	10
Idaho	0	0	3	0	----	----	4	1	41	4	5	4
Wyoming	22	1	0	0	----	----	----	----	153	7	3	3
Colorado	53	11	14	6	34	7	----	----	43	9	13	13
New Mexico	0	0	2	3	----	----	----	----	25	2	2	6
Arizona	12	1	5	1	49	4	10	5	25	2	9	1
Utah [3]	0	0	0	0	20	2	1	----	119	12	35	4
PACIFIC												
Washington	0	0	4	1	----	----	----	----	222	72	11	18
Oregon	0	0	1	1	15	3	9	8	134	27	15	7
California	16	19	16	16	5	6	10	10	145	177	188	91
Total	11	272	327	327	12	263	326	248	44	1,096	1,752	1,752
31 weeks	15	11,492	13,737	14,542	230	151,020	45,372	103,499	452	347,041	758,270	665,401

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median
NEW ENG.												
Maine	6	1	0	0	0	0	0	2	181	30	10	7
New Hampshire	0	0	0	0	0	0	0	0	0	0	2	2
Vermont	0	0	0	0	0	0	1	1	13	1	3	3
Massachusetts	0	0	1	3	2.4	2	0	5	33	28	31	38
Rhode Island	0	0	0	0	0	0	1	1	15	2	2	2
Connecticut	3	1	0	0	0	0	1	1	21	7	6	8
MID. ATL.												
New York	1.6	4	7	9	5	13	9	9	25	63	71	78
New Jersey	0	0	0	0	4	3	2	2	24	20	19	19
Pennsylvania	1.5	3	2	4	1.5	3	1	2	30	59	106	106

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Aug. 5, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median
E. NO. CEN.												
Ohio	0	0	0	3	2.3	3	7	3	38	50	104	59
Indiana	0	0	1	1	1.5	1	1	1	40	27	18	18
Illinois	0.7	1	2	7	2.6	4	5	10	26	40	82	91
Michigan [3]	0	0	2	1	49	46	1	8	55	52	60	60
Wisconsin	4	2	0	0	0	0	0	0	67	38	51	51
W. NO. CEN.												
Minnesota	0	0	0	0	8	4	2	4	56	29	25	25
Iowa	0	0	0	0	6	3	2	0	12	6	18	18
Missouri	0	0	0	1	0	0	1	2	6	5	27	16
North Dakota	0	0	0	0	0	0	1	0	22	3	8	4
South Dakota	0	0	0	0	0	0	1	1	53	7	8	5
Nebraska	0	0	0	0	23	6	0	0	15	4	4	4
Kansas	2.8	1	0	0	11	4	2	2	64	23	24	23
SO. ATL.												
Delaware	0	0	0	0	0	0	0	0	0	0	0	
Maryland [3]	3	1	0	0	3	1	2	2	28	9	6	12
Dist. of Col	0	0	0	1	0	0	2	1	40	5	1	1
Virginia	0	0	2	2	6	3	2	3	28	15	9	9
West Virginia	2.7	1	0	0	0	0	1	1	38	14	9	18
North Carolina [3]	4	3	2	2	2.9	2	2	3	25	17	9	16
South Carolina [3]	0	0	2	1	46	17	0	0	3	1	7	2
Georgia [3]	3	2	0	1	8	5	2	2	18	11	11	7
Florida [3]	0	0	2	0	3	1	1	0	30	10	4	2
E. SO. CEN.												
Kentucky	3	2	4	3	3	2	0	4	42	24	13	16
Tennessee	1.8	1	0	1	5	3	2	3	16	9	11	13
Alabama [3]	1.8	1	2	1	1.8	1	1	3	25	14	6	9
Mississippi [3]	2.5	1	0	0	2.5	1	4	4	25	10	8	5
W. SO. CEN.												
Arkansas	2.5	1	0	0	10	4	2	1	20	8	3	3
Louisiana [3]	0	0	0	0	0	0	0	2	19	8	5	5
Oklahoma	0	0	0	0	0	0	0	0	16	8	6	6
Texas [3]	4	5	2	1	12	14	4	4	12	14	35	31
MOUNTAIN												
Montana	0	0	1	0	0	0	1	1	37	4	8	4
Idaho	0	0	0	0	0	0	2	1	10	1	3	2
Wyoming	0	0	0	0	0	0	0	0	0	0	3	5
Colorado	0	0	0	0	5	1	0	1	82	17	9	12
New Mexico	12	1	0	0	12	1	0	0	49	4	4	3
Arizona	0	0	0	0	37	3	0	0	0	0	1	1
Utah [3]	0	0	0	0	0	0	0	0	70	7	6	6
PACIFIC												
Washington	0	0	0	0	3	1	0	1	12	4	18	10
Oregon	0	0	0	0	5	1	0	1	35	7	4	9
California	0.8	1	1	2	47	57	0	19	30	36	49	50
Total	1.3	33	33	66	8	210	66	250	30	751	927	939
31 weeks	1.7	1,321	2,072	4,027	2	1,544	794	2,315	148	115,033	135,655	163,175

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Aug. 5, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases	1934–38, median	Aug. 5, 1939, rate	Aug. 5, 1939, cases	Aug. 6, 1938, cases
NEW ENG.											
Maine	0	0	0	0	12	2	2	3	223	37	13
New Hampshire	0	0	0	0	0	0	0	0	0	0	1
Vermont	0	0	0	0	27	2	0	0	0	0	35
Massachusetts	0	0	0	0	1	1	2	3	135	115	103
Rhode Island	0	0	0	0	0	0	1	0	84	11	14
Connecticut	0	0	0	0	18	6	3	2	172	58	58
MID. ATL.											
New York	0	0	0	0	5	13	24	18	192	480	579
New Jersey	0	0	0	0	8	7	7	7	311	261	319
Pennsylvania	0	0	0	0	11	21	15	25	265	523	436
E. NO. CEN.											
Ohio	1	1	3	0	16	21	30	30	128	166	444
Indiana	0	0	6	0	10	7	24	18	114	77	7
Illinois	5	7	2	0	18	27	18	19	215	328	491
Michigan [2]	4	4	1	0	1	1	4	6	240	227	279
Wisconsin	0	0	2	3	5	3	3	3	364	207	364
W. NO. CEN.											
Minnesota	2	1	1	1	6	3	0	2	74	38	51
Iowa	8	4	6	3	10	5	9	4	63	31	24
Missouri	0	0	2	1	36	28	10	20	32	25	28
North Dakota	0	0	0	0	0	0	0	2	66	9	16
South Dakota	15	2	0	4	0	0	2	1	8	1	5
Nebraska	8	2	2	2	0	0	0	1	34	9	10
Kansas	3	1	1	0	14	5	5	15	53	19	83
SO. ATL.											
Delaware	0	0	0	0	79	4	0	1	138	7	1
Maryland [2]	0	0	0	0	28	9	13	13	191	62	37
Dist. of Col	0	0	0	0	0	0	0	2	234	29	10
Virginia	0	0	0	0	43	23	19	36	257	137	48
West Virginia	0	0	0	0	38	14	5	15	94	35	19
North Carolina [3]	0	0	0	0	19	13	18	25	146	100	181
South Carolina [3]	0	0	0	0	38	14	20	20	52	19	76
Georgia [3]	2	1	0	0	46	28	43	43	96	58	26
Florida [3]	0	0	0	0	9	3	5	5	48	16	17
E. SO. CEN.											
Kentucky	0	0	1	0	68	39	46	46	68	39	53
Tennessee	0	0	1	0	19	11	40	43	104	59	49
Alabama [3]	0	0	0	0	33	19	26	19	51	29	38
Mississippi [2]	0	0	0	0	33	13	13	18	----	----	----
W. SO. CEN.											
Arkansas	2	1	2	0	94	38	29	29	17	7	8
Louisiana [3]	0	0	0	0	36	15	13	23	247	102	49
Oklahoma	0	0	1	0	38	19	19	23	12	6	18
Texas [3]	0	0	3	0	47	57	83	83	65	79	150
MOUNTAIN											
Montana	0	0	0	2	9	1	0	3	84	9	67
Idaho	0	0	2	2	10	1	6	1	41	4	4
Wyoming	22	1	0	0	65	3	0	1	131	6	4
Colorado	0	0	5	0	10	2	2	2	106	22	45
New Mexico	25	2	0	0	25	2	6	7	185	15	13
Arizona	0	0	0	0	25	2	0	2	74	6	16
Utah [2]	0	0	0	0	10	1	0	1	526	53	52
PACIFIC											
Washington	0	0	6	5	6	2	2	2	43	14	64
Oregon	0	0	5	2	10	2	2	2	70	14	37
California	6	7	25	3	8	10	13	13	122	149	186
Total	1	34	77	52	20	497	582	687	149	3,698	4,628
31 weeks	11	8,610	12,603	6,001	8	6,097	6,980	6,980	158	120,862	134,900

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended August 5, 1939, 139 cases as follows: North Carolina, 8; South Carolina, 9; Georgia, 62; Florida, 8; Alabama, 34; Louisiana, 1; Texas, 17.

ROCKY MOUNTAIN SPOTTED FEVER

Cases reported by States, Feb. 26 to Aug. 12, 1939

State	Feb. 26 to Mar. 25	Mar. 26 to Apr. 22	Apr. 23 to May 20	May 21 to June 17	June 18 to July 15	Week ended July 22	Week ended July 29	Week ended Aug. 5	Week ended Aug. 12
Eastern:									
New York				3	3				1
New Jersey				4	8	1	2	3	1
Pennsylvania				6	3	1		2	1
Delaware				3					
Maryland			7	13	11	5	2	11	5
District of Columbia			2	2	2	1	1		1
Virginia			1	13	10	1	4	3	3
West Virginia									1
North Carolina				3	13	5	2	4	2
Georgia					1		1		
Central:									
Ohio				3	2		2	2	
Indiana				2	1			1	2
Illinois			1	1	5	2		1	4
Tennessee[1]					5	4	1		1
Iowa			1	10	9	2		2	2
Missouri				1			3	1	
Western:									
Montana	[2]2	2	8	5	1		1		1
Idaho		4	7	4	5				
Wyoming		3	14	16	5	3		2	
Colorado		2	3	9	4				
Utah		2	5	5	6	2			
Washington		2	3	2					
Oregon		9	16	7	2				1

[1] Report has been received of change of diagnosis in certain cases previously reported in Tennessee.
[2] 1 other case was reported in Montana as occurring in February, exact date not given.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Diphtheria	Influenza	Malaria	Measles	Meningitis, meningococcus	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid and paratyphoid fever
June 1939										
Utah	1	5		312	1		1	35	6	3
Virginia	30	86	13	1,763	4	15	2	41	0	28
Wisconsin	1	59		1,386	4		0	225	2	4
July 1939										
Connecticut	2	4	1	415	2		3	50	0	6
Iowa	9	1	20	271	1		1	58	53	22
Maine	3	1		171	0		1	80	0	13
Missouri	18		41	15	2		6	59	32	58
Pennsylvania	57		1	262	18		9	406	0	37
Texas	72	193	844	402	7	160	45	74	7	218

June 1939

	Cases
Chickenpox:	
Utah	163
Virginia	230
Wisconsin	946
Dysentery:	
Virginia (amoebic)	1
Virginia (bacillary)	651
German measles:	
Utah	18
Wisconsin	31
Mumps:	
Utah	435
Virginia	190
Wisconsin	663

June 1939—Continued

	Cases
Rocky Mountain spotted fever:	
Utah	4
Virginia	12
Septic sore throat:	
Utah	1
Virginia	49
Wisconsin	6
Tetanus:	
Virginia	1
Trachoma:	
Wisconsin	1

June 1939—Continued

	Cases
Tularaemia:	
Utah	8
Virginia	3
Wisconsin	1
Typhus fever:	
Virginia	2
Undulant fever:	
Utah	4
Virginia	2
Wisconsin	16
Whooping cough:	
Utah	238
Virginia	368
Wisconsin	764

Summary of monthly reports from States—Continued

July 1939	Cases
Actinomycosis:	
Connecticut	1
Anthrax:	
Texas	1
Chickenpox:	
Connecticut	94
Iowa	46
Maine	79
Missouri	22
Pennsylvania	558
Texas	129
Conjunctivitis, infectious:	
Connecticut	1
Dengue:	
Texas	8
Dysentery:	
Connecticut (amoebic)	1
Connecticut (bacillary)	3
Iowa (bacillary)	2
Missouri	17
Pennsylvania (amoebic)	1
Texas (amoebic)	7
Texas (bacillary)	497
Encephalitis, epidemic or lethargic:	
Iowa	2
Pennsylvania	3
Texas	2

July 1939—Continued	Cases
German measles:	
Connecticut	5
Maine	12
Pennsylvania	32
Impetigo contagiosa:	
Missouri	40
Leprosy:	
Texas	1
Mumps:	
Connecticut	95
Iowa	42
Maine	27
Missouri	102
Pennsylvania	440
Texas	112
Ophthalmia neonatorum:	
Pennsylvania	4
Texas	3
Rabies in animals:	
Iowa	1
Rabies in man:	
Missouri	1
Relapsing fever:	
Texas	6
Rocky Mountain spotted fever:	
Iowa	6
Missouri	3
Pennsylvania	2

July 1939—Continued	Cases
Septic sore throat:	
Connecticut	21
Iowa	3
Maine	1
Missouri	1
Trachoma:	
Missouri	80
Texas	2
Tularaemia:	
Iowa	5
Missouri	4
Texas	6
Typhus fever:	
Texas	64
Undulant fever:	
Connecticut	5
Iowa	18
Maine	5
Missouri	2
Pennsylvania	2
Texas	43
Vincent's infection:	
Maine	1
Whooping cough:	
Connecticut	214
Iowa	136
Maine	127
Missouri	196
Pennsylvania	1,962
Texas	579

WEEKLY REPORTS FROM CITIES

City reports for week ended July 29, 1939

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	97	30	12	760	307	319	5	362	71	1,436	----
Current week [1]	62	36	13	369	203	219	2	365	53	1,436	----
Maine:											
Portland	0	----	0	0	0	0	0	0	0	6	17
New Hampshire:											
Concord	0	----	0	0	1	0	0	0	0	0	11
Manchester	0	----	0	0	0	2	0	0	0	0	30
Nashua	0	----	0	4	0	0	0	0	0	0	6
Vermont:											
Barre	0	----	0	0	0	0	0	0	0	0	4
Burlington	0	----	0	1	0	0	0	0	0	0	5
Rutland	0	----	0	0	0	0	0	0	0	0	5
Massachusetts:											
Boston	1	----	0	15	10	13	0	7	0	29	163
Fall River	0	----	0	0	2	0	0	2	0	3	29
Springfield	0	----	0	1	1	1	0	0	0	8	24
Worcester	0	----	0	11	6	1	0	1	0	14	36
Rhode Island:											
Pawtucket	0	----	0	0	0	0	0	0	0	0	19
Providence	0	----	0	27	2	0	0	1	0	19	48
Connecticut:											
Bridgeport	1	----	0	8	0	1	0	0	0	0	29
Hartford	0	----	0	0	0	0	0	0	0	11	35
New Haven	0	----	0	8	1	0	0	1	0	9	27
New York:											
Buffalo	2	----	0	2	2	7	0	6	1	22	117
New York	7	3	1	24	28	29	0	76	3	137	1,246
Rochester	0	----	0	8	3	1	0	0	0	11	67
Syracuse	0	----	0	2	2	0	0	0	0	72	47
New Jersey:											
Camden	0	----	0	0	2	3	0	0	0	3	25
Newark	0	----	0	2	2	2	0	6	2	54	89
Trenton	0	----	0	0	0	0	0	1	0	5	25

[1] Figures for Springfield, Ill. estimated; report not received.

City reports for week ended July 29, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Pennsylvania:											
Philadelphia	1	2	1	21	6	10	0	24	8	167	414
Pittsburgh	2	------	1	1	6	8	0	2	1	36	108
Reading	0	------	0	1	0	0	0	3	1	0	23
Scranton	0	------	------	2	------	0	0	------	0	2	------
Ohio:											
Cincinnati	1	------	0	1	0	2	0	7	0	21	95
Cleveland	1	3	1	4	2	5	0	8	0	56	156
Columbus	0	------	0	0	1	1	0	1	0	4	67
Toledo	0	------	0	6	1	4	0	3	0	38	82
Indiana:											
Anderson	0	------	0	0	0	0	0	0	0	0	4
Fort Wayne	0	------	0	0	0	2	0	1	0	0	22
Indianapolis	1	------	0	1	2	3	0	2	0	72	79
South Bend	0	------	0	1	2	0	0	0	0	26	12
Terre Haute	0	------	0	0	1	2	0	1	0	0	20
Illinois:											
Alton	0	------	0	0	0	0	0	0	0	0	14
Chicago	8	3	1	2	10	32	0	30	1	142	566
Elgin	0	------	0	0	0	0	0	0	0	5	7
Moline	0	------	0	0	0	0	0	0	0	7	7
Springfield	------	------	------	------	------	------	------	------	------	------	------
Michigan:											
Detroit	3	------	1	9	4	11	0	21	0	82	241
Flint	0	------	0	9	1	2	0	0	0	2	28
Grand Rapids	0	------	2	1	0	3	0	0	0	2	21
Wisconsin:											
Kenosha	0	------	0	0	0	4	0	0	0	1	10
Madison	0	------	0	10	0	2	0	0	0	14	11
Milwaukee	0	------	0	0	0	8	0	2	0	20	78
Racine	0	------	0	0	0	2	0	0	0	1	11
Superior	0	------	0	1	0	1	0	0	0	0	5
Minnesota:											
Duluth	0	------	0	2	2	0	0	0	1	3	17
Minneapolis	0	------	0	2	1	2	1	4	0	24	83
St. Paul	0	1	1	1	3	1	0	3	0	29	53
Iowa:											
Cedar Rapids	0	------	------	2	------	0	0	------	1	1	------
Davenport	0	------	------	0	------	0	0	------	1	2	------
Des Moines	0	------	0	0	0	5	1	0	1	0	34
Waterloo	0	------	------	0	------	2	0	------	0	6	------
Missouri:											
Kansas City	0	------	0	0	2	1	0	1	1	2	81
St. Joseph	0	------	0	0	2	0	0	1	0	0	18
St. Louis	0	------	0	0	4	3	0	12	2	25	180
North Dakota:											
Fargo	1	------	0	0	0	0	0	0	0	0	6
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	1	------	0	0	0	0	0	0	0	0	1
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	1	------
Sioux Falls	1	------	0	0	0	3	0	0	0	0	11
Nebraska:											
Lincoln	0	------	------	0	------	1	0	------	0	17	------
Omaha	0	------	0	2	9	0	0	2	0	6	205
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	9
Topeka	0	------	0	0	2	2	0	0	1	1	23
Wichita	1	------	0	0	0	1	0	4	0	3	32
Delaware:											
Wilmington	0	------	0	3	0	3	0	0	0	2	23
Maryland:											
Baltimore	2	2	2	1	5	3	0	11	1	50	188
Cumberland	0	------	0	1	0	2	0	0	1	1	13
Frederick	0	------	0	0	0	0	0	0	0	3	3
District of Columbia:											
Washington	5	------	0	9	11	3	0	13	2	44	157
Virginia:											
Lynchburg	3	------	0	4	0	3	0	0	0	25	13
Norfolk	0	------	0	0	0	0	0	1	0	0	17
Richmond	1	------	0	4	1	0	0	1	2	3	46
Roanoke	0	------	0	10	0	0	0	1	1	1	23
West Virginia:											
Charleston	0	------	0	0	0	0	0	0	0	0	26
Wheeling	------	------	0	------	0	2	------	2	------	7	16

City reports for week ended July 29, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
North Carolina:											
Gastonia	0			0		0	0		0	0	
Raleigh	2		0	0	0	0	0	1	0	3	13
Wilmington	0		0	1	0	0	0	0	0	0	11
Winston-Salem	0		0	0	0	1	0	2	0	0	21
South Carolina:											
Charleston	0	9	0	0	0	1	0	3	5	0	26
Florence	0		0	0	2	0	0	0	0	0	12
Greenville	0		0	0	1	1	0	0	0	2	11
Georgia:											
Atlanta	0		0	0	5	0	0	9	2	0	89
Brunswick	0		0	0	0	0	0	0	0	0	1
Savannah	0	8	0	2	0	0	0	2	1	0	25
Florida:											
Miami	0		0	0	2	1	0	2	0	0	30
Tampa	1		0	2	0	1	0	0	0	0	20
Kentucky:											
Ashland	0		0	0	0	0	0	1	1	0	5
Covington	0		0	0	0	0	0	0	1	0	13
Lexington	0		0	1	0	0	0	1	0	1	18
Louisville	0		0	0	3	1	0	2	0	35	58
Tennessee:											
Knoxville	0		0	0	1	1	0	1	0	0	19
Memphis	0		0	0	2	1	0	9	2	25	95
Nashville	1		0	0	3	1	0	0	1	11	42
Alabama:											
Birmingham	0	2	0	0	4	0	0	3	0	6	78
Mobile	0		0	0	2	0	0	1	0	5	27
Montgomery	0			0		0	0		0	0	
Arkansas:											
Fort Smith	0			0		0	0		1	0	
Little Rock	0		0	0	1	0	0	0	0	2	17
Louisiana:											
Lake Charles	0		0	1	0	0	0	0	0	0	5
New Orleans	0	1	0	0	9	1	0	10	2	0	132
Shreveport	0		0	0	4	0	0	3	0	2	42
Oklahoma:											
Oklahoma City	1		0	0	2	1	0	0	0	0	37
Texas:											
Dallas	4		0	1	2	2	0	5	0	2	56
Fort Worth	0		0	1	4	0	0	1	0	0	34
Galveston	0		0	0	0	0	0	5	0	0	18
Houston	1		0	1	2	0	0	6	3	6	69
San Antonio	0		1	0	4	0	0	12	2	0	89
Montana:											
Billings	0		0	0	0	0	0	0	0	3	8
Great Falls	0		0	8	1	3	0	0	0	0	8
Helena	0		0	0	0	0	0	0	0	0	3
Missoula	0		0	1	0	1	0	0	0	0	6
Idaho:											
Boise	0		0	1	2	0	0	0	0	0	7
Colorado:											
Colorado Springs	0		0	0	0	5	0	1	0	0	11
Denver	6		0	2	1	5	0	6	1	20	68
Pueblo	0		0	1	0	0	0	0	0	12	4
New Mexico:											
Albuquerque	0		0	0	0	1	0	2	3	0	8
Utah:											
Salt Lake City	0		0	5	0	2	0	2	0	22	25
Washington:											
Seattle	0		1	89	2	2	0	2	0	3	84
Spokane	0		0	2	0	0	0	0	2	0	27
Tacoma	0		0	6	0	0	0	3	0	0	35
Oregon:											
Portland	0		0	5	1	1	0	1	0	2	63
Salem	0			3		0	0		0	0	
California:											
Los Angeles	5	2	0	40	13	20	0	18	1	16	308
Sacramento	0		0	4	0	2	1	1	2	2	19
San Francisco	1		0	2	4	3	0	4	0	2	155

City reports for week ended July 29, 1939—Continued

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
New York	1	1	7
Rochester	0	0	1
Pennsylvania:			
Philadelphia	1	0	2
Pittsburgh	0	0	1
Scranton	1	0	0
Ohio:			
Toledo	0	0	1
Indiana:			
South Bend	1	0	0
Illinois:			
Chicago	0	0	3
Michigan:			
Detroit	0	0	31
Minnesota:			
Minneapolis	0	0	1
Iowa:			
Des Moines	0	0	1
North Dakota:			
Fargo	0	0	1
Nebraska:			
Omaha	0	0	1
Kansas:			
Wichita	0	0	1
District of Columbia:			
Washington	1	0	0
South Carolina:			
Charleston	0	0	5
Georgia:			
Savannah	0	0	1
Florida:			
Tampa	0	0	1
Kentucky:			
Lexington	0	0	1
Tennessee:			
Memphis	0	1	0
Alabama:			
Birmingham	1	1	0
Utah:			
Salt Lake City	0	0	1
California:			
Los Angeles	0	0	4

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Rochester, 1; St. Louis, 1; Birmingham, 1; Salt Lake City, 1.

Pellagra.—Cases: Boston, 2; Baltimore, 1; Charleston, S. C., 3; Savannah, 8; Memphis, 1; Nashville, 2; Birmingham, 1.

Typhus fever.—Cases: New York, 1; Wilmington, N. C., 1; Charleston, S. C., 2; Atlanta, 1; Brunswick, 1; Savannah, 8; Miami, 1; Mobile, 2; Houston, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended July 15, 1939.—During the week ended July 15, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		5		57	98	40	20	26	28	274
Diphtheria		2	4	24		5	1			36
Dysentery				1	1					2
Influenza									6	6
Measles		31	7	268	418	30	5	7	4	770
Mumps				11	22	11		6	4	54
Pneumonia		8			8				4	20
Poliomyelitis					2	1				3
Scarlet fever	2	1	13	36	52	7		9	4	124
Trachoma							2			2
Tuberculosis	1	27	4	75	70	3		1		181
Typhoid fever		2	2	10	5					19
Whooping cough		18		84	90	19	49	82	27	369

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases for a six-month period appeared in the PUBLIC HEALTH REPORTS for July 28, 1939, pages 1409–1421. A similar cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Argentina—Anchorena.—During the period July 16 to 31, 1939, 1 case of plague, with 1 death, was reported at Anchorena, Argentina.

Smallpox

Italy—Sicily—Palermo.—During the two weeks ended July 15, 1939, 13 cases of smallpox were reported in Sicily, including 4 cases at Palermo.

Spain.—During the week ended June 17, 1939, 1 case of smallpox was reported at Valencia, and 1 imported case of the disease was reported at Barcelona during the week ended July 8.

Yellow Fever

Colombia—Department of Antioquia—Caracoli.—During the week ended July 1, 1939, 1 death from yellow fever was reported at Caracoli, Colombia.

Cameroon—Bafia.—Report was received under date of August 3, 1939, of 1 case of yellow fever at Bafia, Cameroon.

Nigeria—Ikot Ekpene.—On July 24, 1939, 1 case of yellow fever was reported at Ikot Ekpene, Nigeria.

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