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## A FURTHER STUDY OF THE MODE OF ACTION OF METHYLCHOLANTHRENE ON NORMAL TISSUE CULTURES

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In a previous paper (*5*) the authors described the action of 20-methylcholanthrene on a series of tissue cultures of fibroblasts from the abdominal musculature of an adult mouse. These cultures were grown in a medium which consisted of horse serum, chick embryo juice, and a physiological saline. The record of these cultures was carried to 59 days, or, in other words, to 54 days after the first addition of the drug. The present paper is concerned with the later history of this series of cultures (series 188), and carries the record up to a total time of 380 days after the first addition of methylcholanthrene.

The data on cultures of series 188 have also been supplemented and confirmed by data from two other series of cultures (series 189 and 191). Data on these two series are presented up to 262 and 252 days, respectively, after first addition of methylcholanthrene to the cultures. At this time all three series of cultures were closed owing to a bacterial infection which had occurred a few days previously.

All of these cultures subjected to the methylcholanthrene showed characteristic changes in the cells. These changes persisted after the addition of methylcholanthrene to the cultures was discontinued and the cultures were shifted into fresh medium.

### MATERIALS AND METHODS

The general methods used in this study and the conditions of handling the cultures for all three series are those previously outlined. For more detailed information reference is made to the previous paper (*5*). It may be emphasized that at no time during the life of these cultures were they subjected to white light and even after discontinuance of the methylcholanthrene all cultures were handled and examined only under light of wavelengths of 480 mμ or longer.

As outlined in the previous paper, series 188 consisted of 5 sets of cultures, each set including 6 cultures. The cultures were all originally

from freshly explanted strips of the entire thickness of the abdominal musculature of $C_3H$ mice. These sets were designated A, B, C, D, and E, respectively, and were subjected to culture fluids carrying concentrations of 0.1, 0.02, 0.002, and 0.0002 mg. of highly purified methylcholanthrene for each cubic centimeter of culture fluid, respectively, for the first four sets. At about 60 days, set B was reduced from 0.02 mg. to 0.01 mg. This concentration was continued through the rest of the time the cultures were left in contact with the carcinogen. Set E received no methylcholanthrene and served as a control. In all cultures which received the carcinogen it was added in the form of a fine suspension in the culture medium.

Series 189 was explanted as strips about $1 \times 15$ mm. in size, all cut from a stock culture originally explanted about 180 days earlier from the dorsal musculature of a $C_3H$ adult male mouse. Growth of fibroblasts from these strips was excellent. In this series 26 cultures were started, of which 3 received no methylcholanthrene and served as controls. These 3 will be designated as set 189–E. The remainder of the cultures, which will be designated as set 189–A, were started on 0.01 mg. of methylcholanthrene per cubic centimeter of culture fluid 11 days after explantation into fresh flasks. This concentration of methylcholanthrene was continued, as noted below, up to a total time of 230 days after first addition of the carcinogen to the cultures.

Series 191 was originally explanted from stock cultures of adult $C_3H$ mouse subcutaneous connective tissue fibroblasts which had been carried in culture in the above described culture medium for about 180 days. Strip cultures similar to those of series 188 and 189 were used as explants. These were transferred to 29 fresh flasks. Methylcholanthrene was added in these cultures 15 days after this explantation. As in series 189, 0.01 mg. of the carcinogen was used in each cubic centimeter of fluid culture medium. These cultures will be designated as culture set 191–B. A group of 6 control cultures was also started. This control group was not subjected to methylcholanthrene and will be designated as culture set 191–E.

To allow ready comparison of the conditions used in these cultures, the respective culture conditions and transfer frequencies have been summarized in chart 1.

In some older work, never reported, a study was made of the characteristics of several strains of cells isolated from rat tumors which arose subcutaneously in Wistar rats following the injection of about 10 mg. of methylcholanthrene in each rat. All tumors arose at the injection sites. One strain of these tumor cells was carried for more than 90 days in culture in the same standard medium previously described (*5*). This strain was finally closed for lack of immediate use. The cells of this strain are compared briefly with the mouse cells treated with methylcholanthrene *in vitro*.

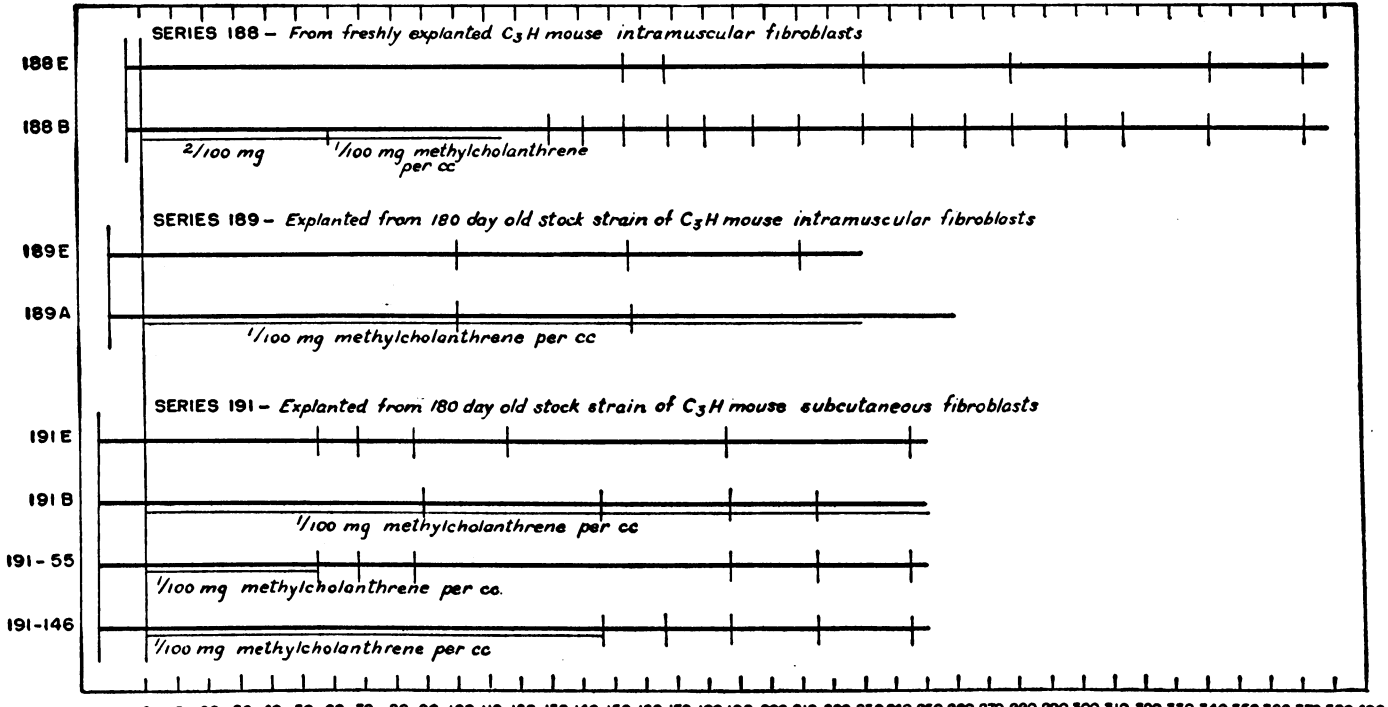


CHART 1.—General course of series 188, 189, and 191 cultures. The time during which the cultures were carried is indicated by the heavy black horizontal lines. The time during which methylcholanthrene was added to the cultures is shown by the light horizontal lines under the heavy lines. Transfers to fresh flasks are indicated by short vertical lines. Culture series and sets are designated at the left of the chart.

CONTINUED HISTORY OF THE CULTURES OF SERIES 188

At the end of about 60 days after the first addition of methylcholanthrene, a number of the cultures, particularly in set A, had died or were in such poor condition that it was useless to carry them longer. In sets C and D a number of the cultures were sacrificed for examination and several were lost through accident. No cultures were sacrificed from set B, however. Since it was desired to keep exposure of the cultures to light down to the lowest practicable level in the period from 60 to 114 days after first addition of the carcinogen, the cultures were subjected only to infrequent brief microscopic examination.

At 98 days after first addition of the carcinogen it was observed that through all the methylcholanthrene-treated cultures there was a noticeable amount of cell disintegration. In the controls there was markedly less. In sets C and D there was practically as much disintegration of the cells as was seen in the surviving cultures of sets A and B. In all of the living cultures, however, occasional cells in division were seen.

Degeneration became increasingly severe with age, until at about 115 days after methylcholanthrene was first added to the cultures their condition was such that it seemed unsafe to carry them any longer in the carcinogen. At this time the series consisted of 1 culture from set A, 3 from set B, and 1 from set D. The A and D cultures were in extremely poor condition. The addition of methylcholanthrene to the cultures was therefore discontinued. Fifteen days later the cultures were all removed from the respective flasks and representative strips cut from them. These strips were rinsed in saline and then explanted into fresh culture medium to which no methylcholantrene was added.

Of these various cultures, those from sets A and D both died. One culture from set B was lost by accident. A second culture from set B showed some growth, but on a later transplantation showed only sparse growth and soon died. The last culture of set B, when it was transplanted, was transferred as 3 strips, each to a separate flask. Each of these strips grew satisfactorily. The control flasks, from a culture of set E transplanted at the same time, grew in their usual luxuriant manner.

Within a very few days after the transplantation it was obvious that the growth of the carcinogen-treated cells of the 3 surviving cultures was quite different from that of the controls transferred at the same time. Whereas the controls showed their usual luxuriant, somewhat loose growth of clear, nongranular cells of relatively uniform size and spindle shape, the carcinogen-treated cultures showed a smaller growth area of extremely granular cells. These cells manifested great irregularity of size and shape. In contrast to the cells of the controls, these cells seemed to have a greater tendency to assume rounded, or

circular, flattened shapes. The general nature of this difference is shown by comparison of two later photographs, figures 2 and 3.

Since it was certain that at least traces of carcinogen remained in the cultures, they were subjected to only very limited examination for about 90 days after this first explantation, for fear that excessive exposure to light might have an injurious action. All of these examinations were made under light of 480 mμ wavelength or longer.

An examination of these cultures 25 days after omission of methylcholanthrene and 10 days after transfer to fresh flasks showed that, whereas the controls were growing well and were forming rather diffuse cultures of cells free from gross granulation and necrosis, the cultures which had been treated with the carcinogen still tended to form a fairly dense growth of distinctly more granular cells. This growth already showed marked evidence of central necrosis and also showed some slight diffuse peripheral necrosis. At this time the cultures were transferred to fresh Carrel flasks and continued growing, without, however, losing characteristic differences from the controls. A representative area of a carcinogen-treated culture, photographed at 38 days after discontinuance of the carcinogen, is shown in figure 3, and may be compared with figure 2, a typical control culture.

Up to June 22, 1939, these cultures had been carried 265 days after the carcinogen was first omitted. During this time they were transferred to fresh flasks from 13 to 15 times, different cultures having had slightly different intervals of subculture. After the first transfer the cultures grew rapidly. In addition to these 13 to 15 complete changes of culture medium, each culture was soaked for at least 1 hour, with 1-cc. lots of saline at each culture fluid change. This totaled more than 100 washings for each culture. Each culture also received more than 100 fresh 1-cc. lots of fluid culture medium. These lots were each left in the flask from 2 to 3 days. In spite of these numerous changes of culture fluid, with necessary consequent reduction of methylcholanthrene concentration in the cultures to extremely low levels, this strain of cells maintained a characteristic morphology and physiology quite different from that of the controls. The differences observed between the methylcholanthrene-treated strain and its controls, as characterized in cultures of from 160 to 260 days after discontinuance of the methylcholanthrene, are summarized below. A comparison is also made of these 2 cell strains with a strain of rat sarcoma cells which arose from the injection of methylcholanthrene and which were carried in culture for more than 90 days.

1. After explantation the rate of increase in the diameter of the carcinogen-treated culture was slower than was that of the control. This is illustrated in chart 2, which shows data from a group of 4 control cultures and a group of 6 carcinogen-treated cultures of series 188. The data presented in this chart were obtained from 165 to 181

days after removal of the cultures from the carcinogen. In respect to this relative retardation of the rate of increase of diameter of the culture, the carcinogen-treated cultures were similar to cultures that were studied from the tumors induced in rats by injection of methylcholanthrene.

2. The control cells from set E had the tendency to form rather loose cultures with very diffuse edges. The carcinogen-treated cells tended

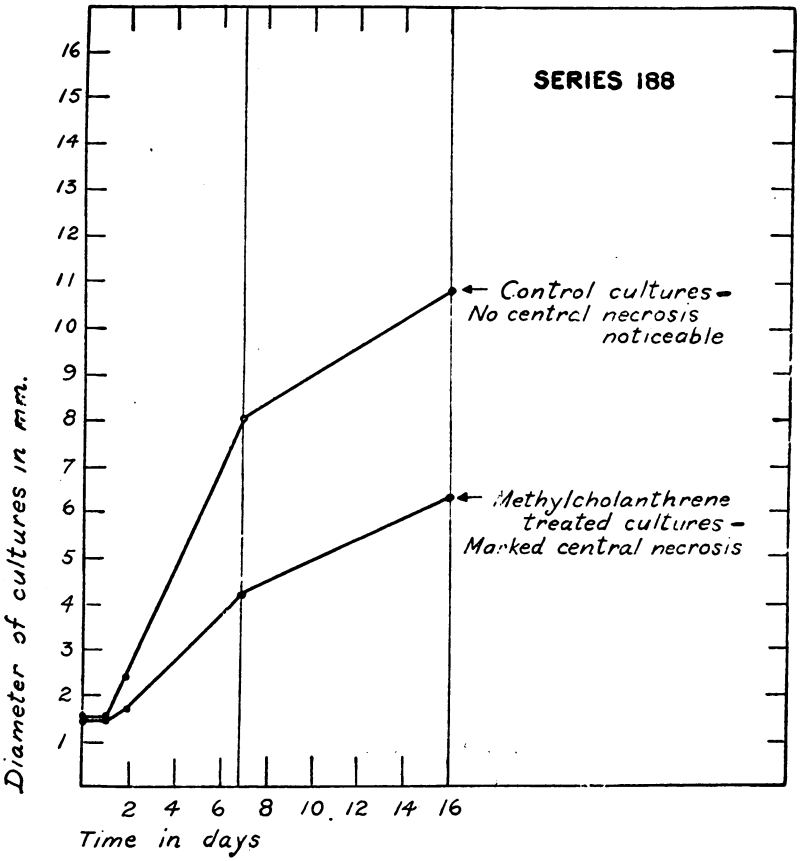


CHART 2.—Curves showing the rate of increase in the diameter of carcinogen-treated cultures and controls. The control set consisted of 4 cultures from series 188; the carcinogen-treated set included 6 cultures. Curves were started at 165 days after omission of the carcinogens.

to form extremely compact cultures with sharply def ned edges. This difference is illustrated in figures 1 and 4 which show representative control and carcinogen-treated cultures. The carcinogen-treated culture here shown was taken at 67 days after removal from the carcinogen, and 13 days after the last transfer to fresh flasks. This dissimilarity of culture architecture was regularly seen even when the two cultures were grown side by side in the same flask. An instance of this is shown in figure 7. In this figure are shown two such cultures

growing under identical conditions in the same culture flask. The small dense culture is from series 188 carcinogen-treated cells, about 172 days after the carcinogen was omitted. The larger, diffuse culture is a control. Both cultures had grown in this flask about 7 days when the photograph was taken. In figure 6 is shown a low-power view of a 7-day culture from the fifth *in vitro* generation of a rat sarcoma induced by methylcholanthrene. In spite of the difference in the lighting of the cultures, the remarkable similarity of this type of culture architecture to that of the carcinogen-treated culture is readily seen by comparing figures 6 and 7, while the equally notable difference from the architecture of the control culture is also easily seen.

3. While the control cultures grew for quite long periods of time with practically no central necrosis, the carcinogen-treated cultures showed marked central necrosis at about 15 to 20 days after explantation. This is illustrated, for instance, in chart 2. In this respect the carcinogen-treated cultures were definitely similar to cultures of sarcoma which we have examined and which arose from intramuscular or subcutaneous injections of methylcholanthrene into rats.

At about 15 to 20 days after the transfer of carcinogen-treated cultures there was often a very slight diffuse necrosis throughout the cultures. Frequent mitoses were observed, often in close juxtaposition with necrotic cells. This same phenomenon was also observed in the rat sarcoma cultures.

This difference in the necrosis rate and necrosis design of the methylcholanthrene-treated cultures and their controls was even more clearly shown in two sets of slide cultures which were examined. After the original explantation these two sets received no fresh culture medium. Consequently, unlike the flask cultures, on which medium was changed every 2 days, the slide cultures used their medium to exhaustion. In these cultures, at 5 days after explantation, all of the methylcholanthrene-treated cultures were entirely necrotic. In the control cultures, in some of which the cell clump was of substantially larger size, the cells were merely rather granular, and sometimes slightly rounded. There was no general necrosis.

4. While the control cultures showed cells extremely free from granulation and fat droplets, the carcinogen-treated cells showed a definite tendency to greater granularity and a greater amount of small fat droplets. This may be seen, for instance, by comparison of figure 2 with figures 3, 5, 12, and 14. This same tendency was also characteristic of the cultures of methylcholanthrene-induced rat tumors which we have examined.

5. In the control cultures the cells had a tendency to form slightly flattened spindle shapes, often with long terminal threads at the ends of the cells. This may be seen in figures 1, 2, and 11. There was

often a characteristic connection of the cells by these terminal processes. In the methylcholanthrene-treated cultures, these long, slender terminal processes were almost entirely absent, and even when seen, as in figure 12, appeared shorter and less slender than usual. The terminal processes of these carcinogen-treated cells were short, blunt, often lobulated, ameboid, irregular membrane-like. Various forms of this growth may be seen in figures 3,[1] 5, 10, 14, and 15. In this respect, they were quite similar to the cultures of methylcholanthrene tumor cells, as may be seen from figure 9.

6. In the control cultures the cells showed a general tendency to remain laterally discrete from one another, as may be seen from figures 1, 2, and 11. In the carcinogen-treated cultures there was a definitely marked lateral adhesion of the cells to one another. This lateral cohesion of the cells was manifested by the formation of broad ribbons of cells, and, commonly, sheets of cells. These may be seen in figures 3, 5, 10, 13, 14, and 15.

Where the cells were terminally joined to each other to form ribbons of cells, these ribbons were of relatively uniform diameter along their length and without great constriction in passing from one cell to the next, as shown in figure 12. These ribbons were sometimes quite long and smooth. In other cultures they were quite irregular, arborescent, with irregular branchings. Different types of this ribbon structure may be seen in figures 10 and 12. In numerous instances long ribbons extended out into the culture medium, then turned, and the peripheral end finally joined with the mass of the culture, or with another ribbon, and so produced an enclosed area of culture medium. In further growth of the culture this frequently gave the extreme appearance of a fenestrated cell layer, as shown in figures 13 and 14, where just such a process of enclosure has taken place.

Where sheets of cells occurred the constituent cells of the sheets were so closely adherent as often to appear as epithelial sheets with typical epithelial-like edges. These edges were lobulated, ruffled, or in some cases showed strands or ribbons of cells. These forms may be seen in figures 4, 5, and 15. We have seen similar sheets in cultures of the Walker 256 rat mammary carcinoma. We have not, however, so far observed this striking lateral adhesion with sheet formation in nearly so clear a form in cultures from methylcholanthrene-induced rat tumors. It was usual in these tumor cells, however, to see the degree of cohesion shown in figures 8 and 9.

7. Whereas in the control cells there was often a slight rippling of the extreme terminal processes of the cells, in the methylcholanthrene-treated cells, as may be seen from figure 15, this rippling was often extremely prominent and extended, in numerous instances, well up

[1] The thread-like objects seen in figure 3 are not all processes but are due to a badly scratched Carrel flask.

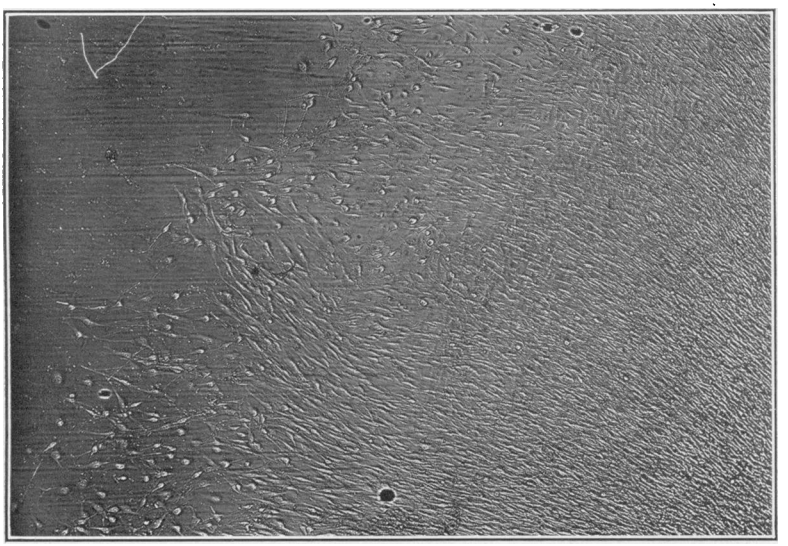

FIGURE 1.—Control culture from series 188. Low power to show general structure of the culture. Note looseness of the culture, the spindle shape of the cells, their long slender terminal processes, and the lack of lateral cohesion. The photograph was taken when the carcinogen-treated cells of the series had been removed from the carcinogen for 172 days. The culture was transferred to a fresh flask 7 days earlier. This figure and figure 2 are representative of the control cultures. While controls were carried on all cultures, the appearance of all controls was so similar they will not be presented except to illustrate some special point. × 38.

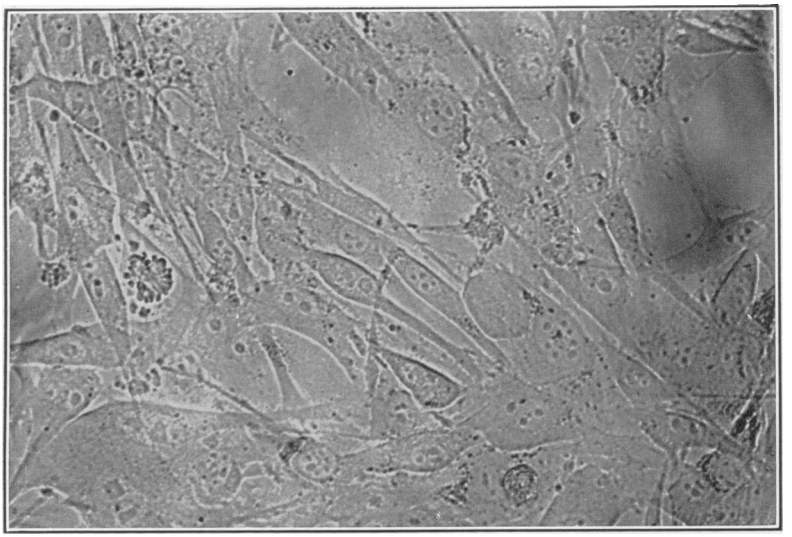

FIGURE 2.—A higher power view of a control culture from the same set of series 188. This culture was taken 172 days after the carcinogen was omitted from the treated cultures and 7 days after the last transfer to fresh flasks. Note the characteristic cell shape, long slender terminal processes, and lack of lateral cohesion. × 290.

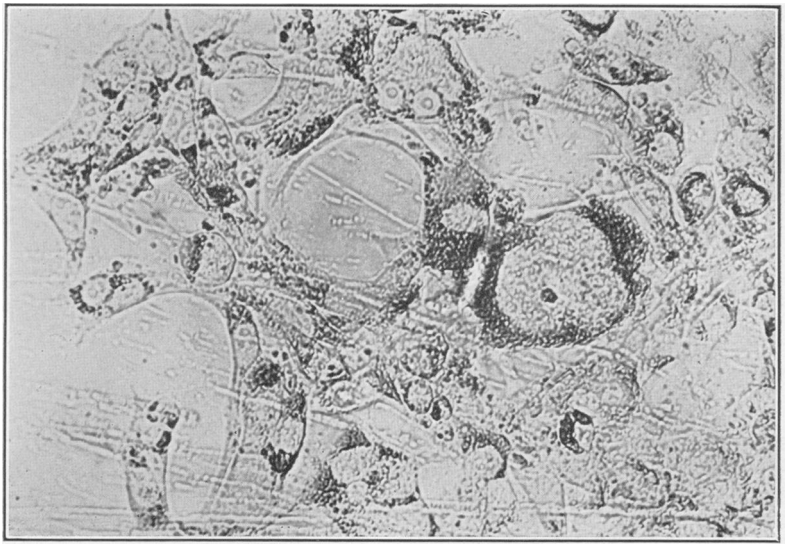

FIGURE 3.—Carcinogen-treated culture of series 188, 38 days after the carcinogen was omitted, and 14 days after transfer to fresh flask. Note irregular cell size and much granulation within the cells. The large cell in the center seemed to have three nuclei. × 290.

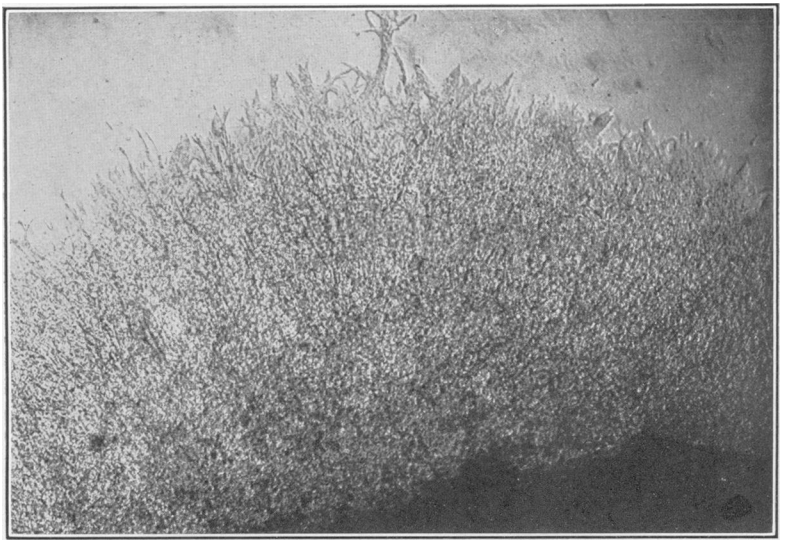

FIGURE 4.—Carcinogen-treated culture from series 188 at 67 days after discontinuance of the carcinogen and 13 days after the last transfer to fresh flasks. Note the density of the culture, the sharpness of the edges of the culture, and the epithelial-like character of the growth resulting from lateral cohesion of the cells. × 38.

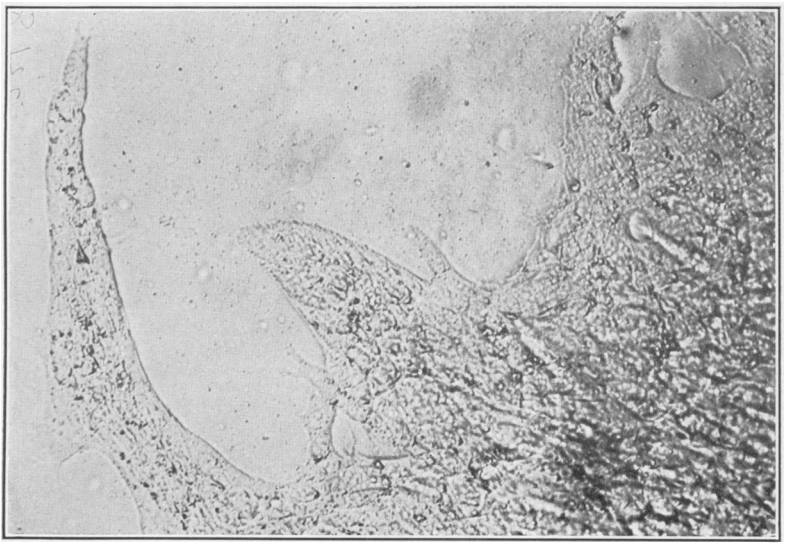

FIGURE 5.—Higher power of culture of a carcinogen-treated culture from the same set as in figure 4. Note the epithelial-like lobes of cells. × about 250.

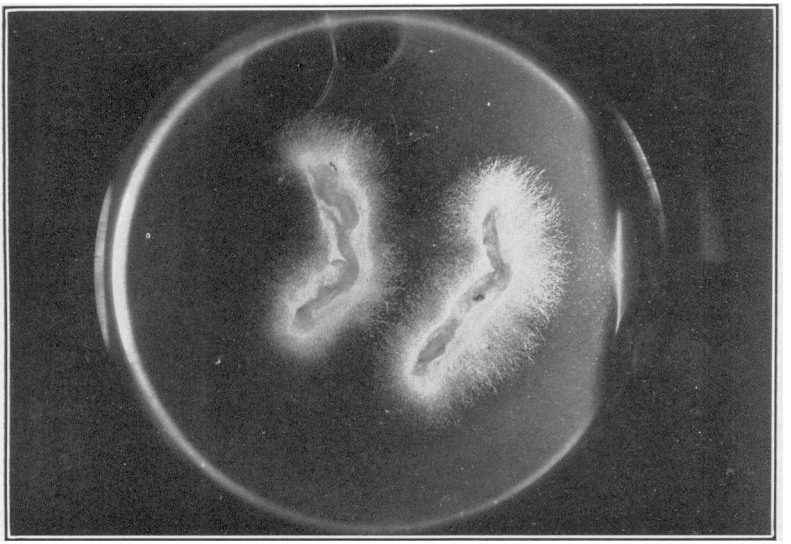

FIGURE 6.—Low-power photograph of a 7-day-old strip culture of a rat sarcoma which arose from the subcutaneous injection of methylcholanthrene. This tumor had been carried *in vitro* for five generations. Although the lighting of the culture is different the similarity to the carcinogen-treated culture in figure 7 is obvious, while the dissimilarity to the control culture in that figure is equally clear. × 2.2.

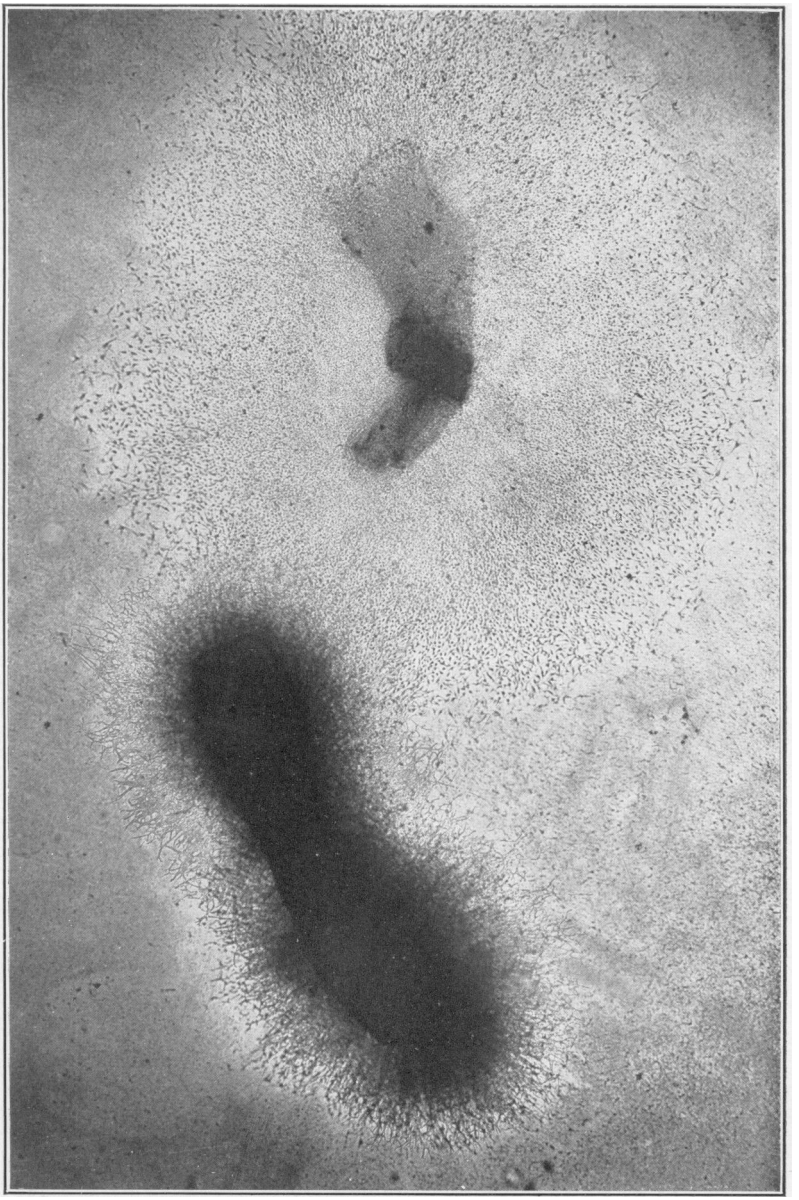

FIGURE 7.—Low-power photograph of a carcinogen-treated culture and a control, both from series 188, growing side by side in the same flask. This photograph was made about 172 days after the carcinogen was discontinued from the carcinogen-treated culture and about 7 days after both cultures were explanted to this flask. × 6.5.

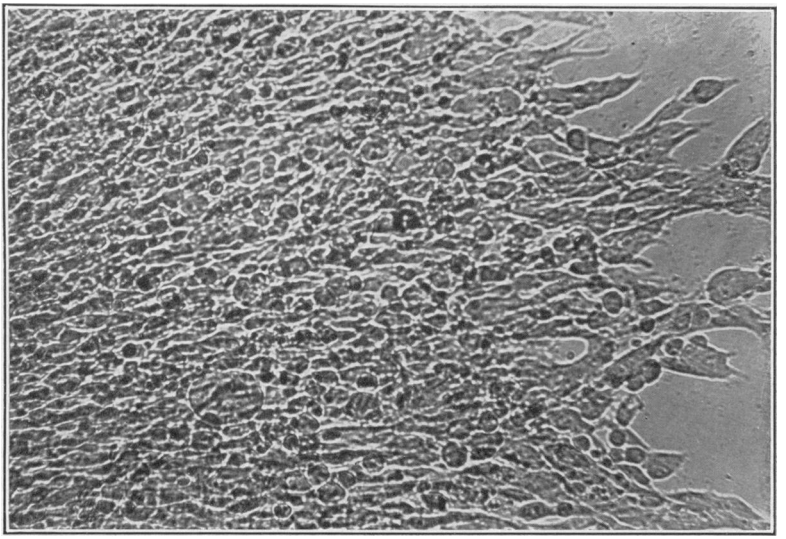

FIGURE 8.—General cell arrangement in a culture of a rat tumor which originated from the action of methylcholanthrene. Note the density of the culture and the sharpness of its outer edges. Note the presence of some lateral adhesion of the cells and the similarity of these features to those of figures 10 and 14.

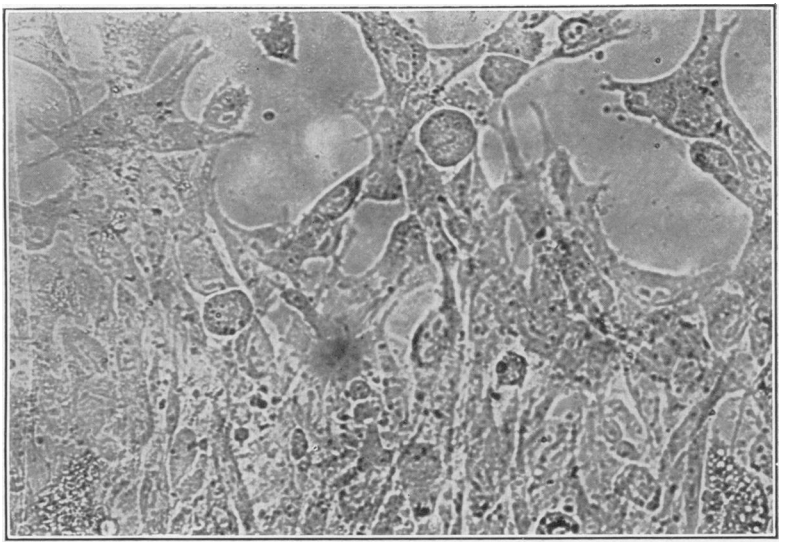

FIGURE 9.—Higher power view of the same culture, from a rat sarcoma, shown in figure 8. Note the lack of long slender terminal processes on the cells, the tendency toward amoeboid edges, and the granularity of the cells. Note the similarity of the cells to those shown in figures 10 and 14. × 290.

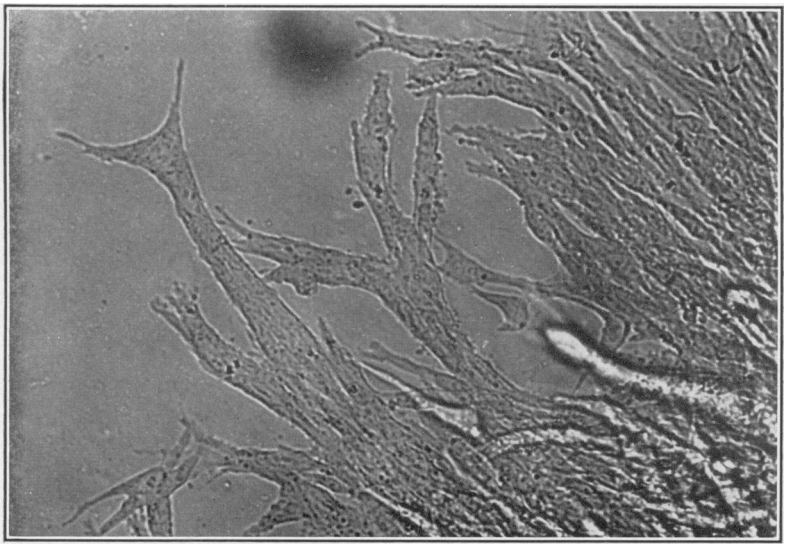

FIGURE 10.—Carcinogen-treated culture from series 188, 133 days after removal from the carcinogen and 1 day after explantation to a fresh flask. Note the lateral adhesion of the cells, the formations of long ribbons of cells, the absence of long slender terminal processes, and the amoeboid edges of the cells. × 290.

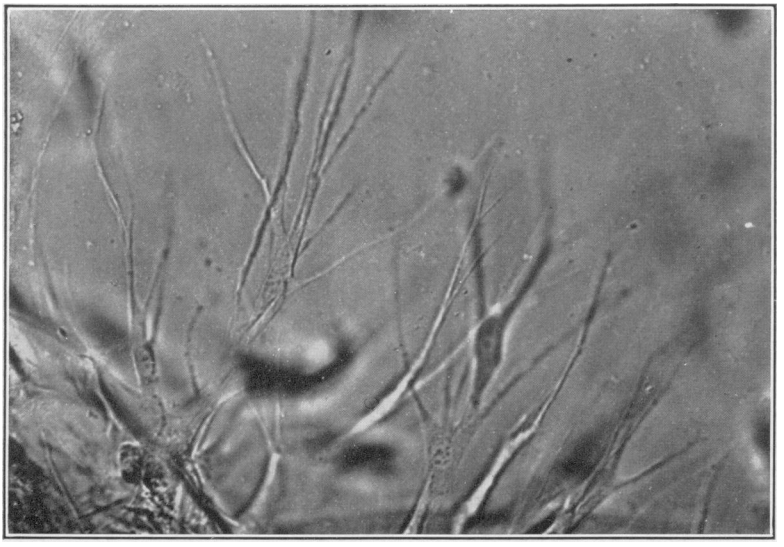

FIGURE 11.—Control on culture shown in figure 10, 1 day after transfer to fresh flask. Note the lack of lateral adhesion of the cells, the long slender cell processes, and the relative absence of amoeboid ruffling of the cell edges. × 290.

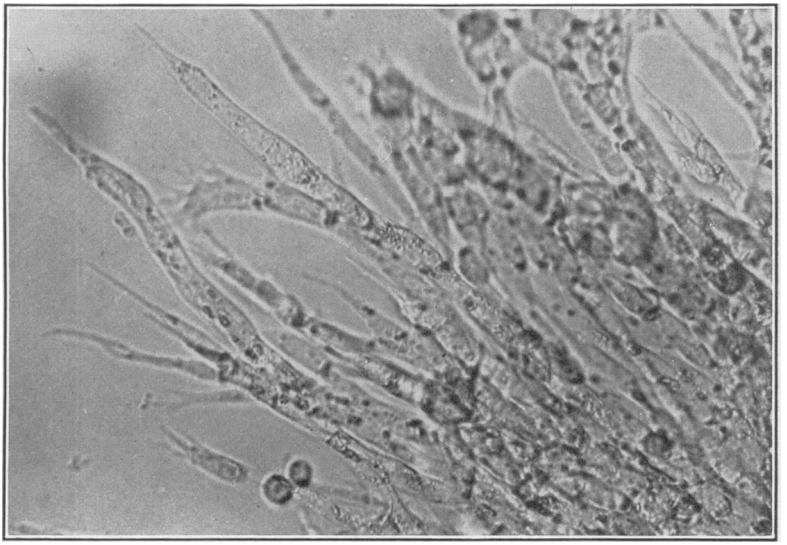

FIGURE 12.—Culture from series 188, 162 days after omission of the carcinogen and 7 days after explantation to a fresh flask. Note the ribbon or rod-like structure of the cells. Note also the granulation within the cells. × 290.

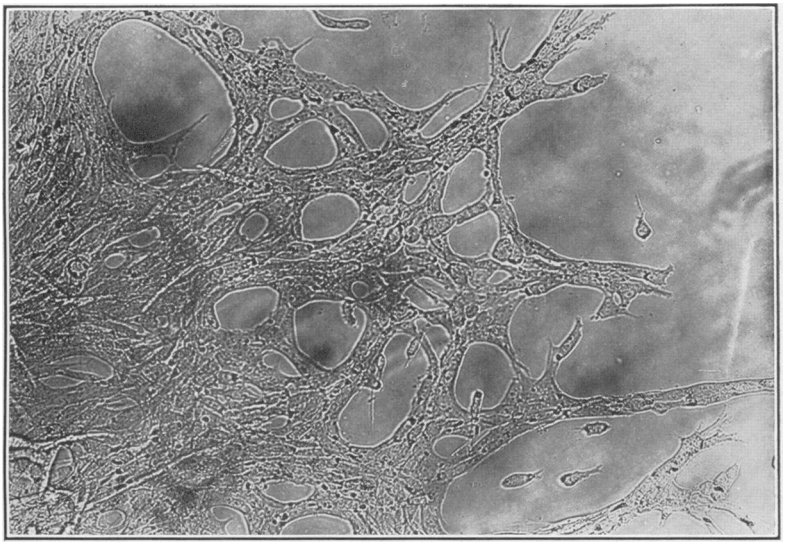

FIGURE 13.—Culture from series 188, 265 days after omission of the carcinogen and 7 days after last transfer to fresh flask. Note the ribbon-like structure of the edge of the culture and the enclosure of spaces by growing ribbons of cells. × 290.

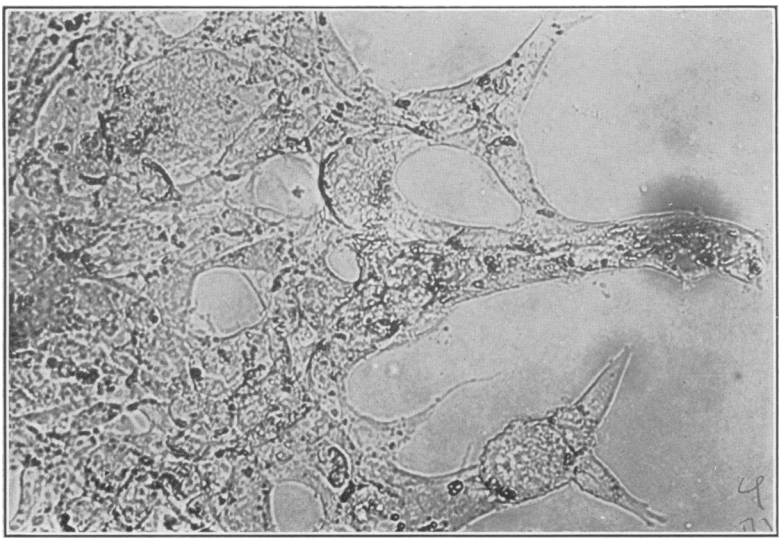

FIGURE 14.—Culture from series 188, 162 days after omission of the carcinogen and 7 days after last transfer to fresh flask. A higher powered photograph of such an area as that shown in figure 13. × 290.

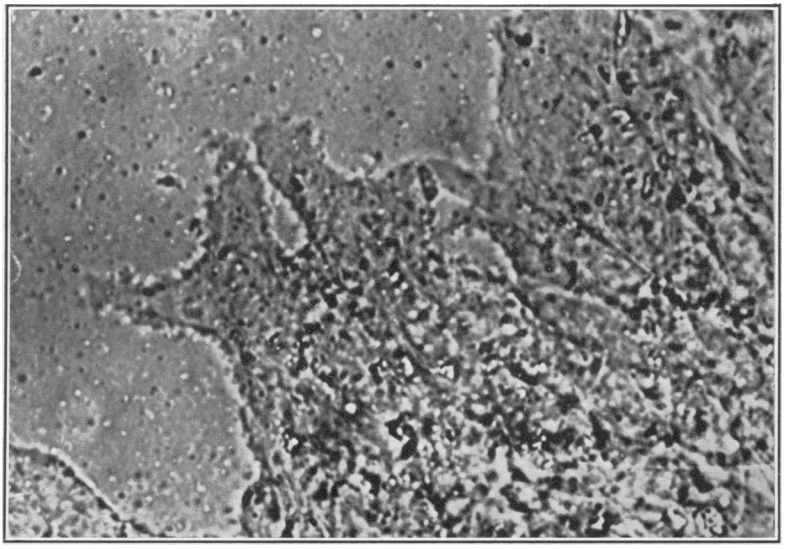

FIGURE 15.—Edge of epithelial-like sheet in carcinogen-treated cultures of series 188, 67 days after discontinuance of carcinogen and 12 days after last transfer to fresh flask. Note the epithelial-like lobes of the sheet and the rippling of the edge of the sheet. × 720.

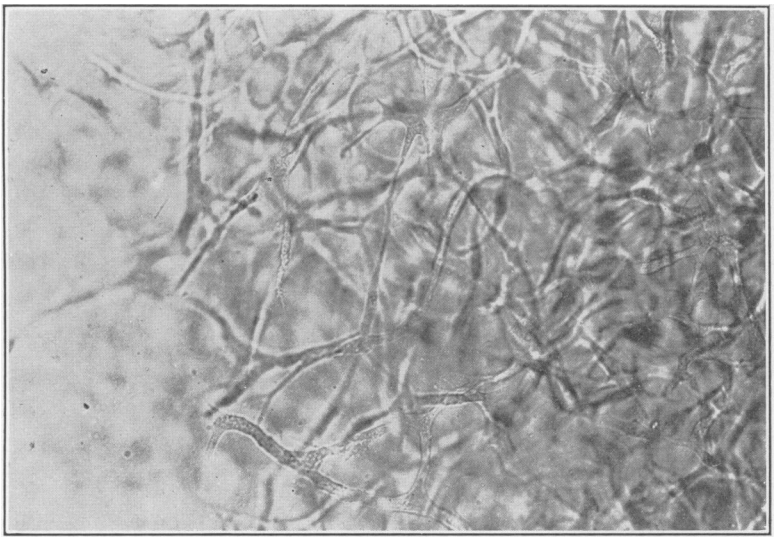

FIGURE 16.—Carcinogen-treated culture from series 191–146. This culture was carried 106 days after the carcinogen was omitted, and the photograph was taken 7 days after the last transfer. Note that in this area the general architecture of the culture is that of interfusing ribbons of cells. Note that these ribbons lie at all planes within the plasma clot. × 144.

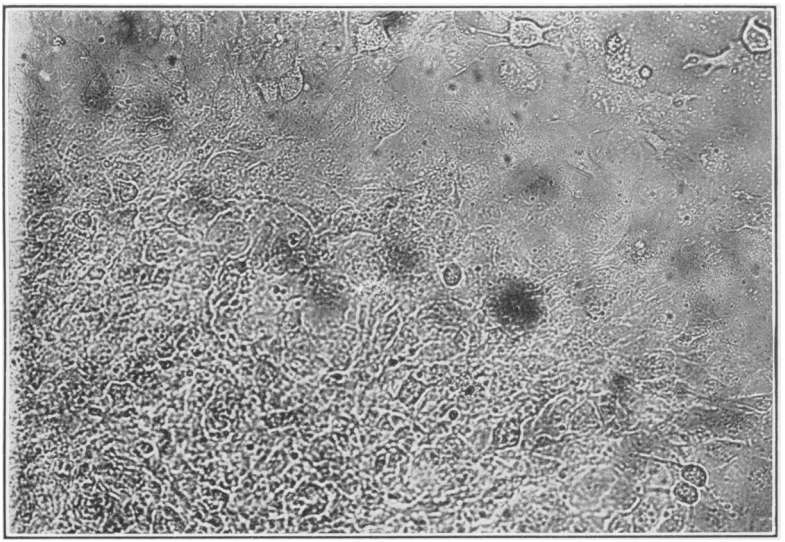

FIGURE 17.—Carcinogen-treated culture from series 191–146, 106 days after the carcinogen was omitted and 7 days after last transfer. Note that almost the whole field consists of a more or less continuous sheet of laterally adherent cells. × 144.

the sides of the cells. This was seen even in long, slender cells. This rippling, in some instances, was quite extreme. Actual pinocytosis was never observed in methylcholanthrene-treated cultures although it was observed in methylcholanthrene-induced tumor cultures.

8. While in the control cultures, even at an advanced age, there was great uniformity of cell size, in the carcinogen-treated cultures there was a great irregularity in the size of various cells at an extremely early age in the growth of the culture. This may be illustrated by a comparison of figures 2 and 3. It may be noted that this change was also observed in cultures of cells from tumors which resulted from the injection of methylcholanthrene into rats.

At about 83 days after removal of the cultures from methylcholanthrene, a total of 12 mice were injected with one culture each of these carcinogen-treated cultures. In no instance did there result a growth of any type, although all mice were held for at least 180 days after injection.

## HISTORY OF SERIES 189

Series 189, for the same reasons as outlined for series 188, was examined only infrequently during the first 100 days of its growth. During this time there was noted some degenerative action from the methylcholanthrene but not sufficient to result in the destruction of the cultures. There was obvious retardation of the growth, however, as the treated cultures grew at a substantially slower rate than did the controls. This slower rate was evident in both the lesser diameter and lesser density of the carcinogen-treated cultures. Because of the increased degeneration of the cultures in the same flask with the passage of time, the cultures were transferred to fresh flasks at about 101 days after the first addition of carcinogen. Methylcholanthrene was immediately added to each subculture of this series.

In the first subculture in the presence of methylcholanthrene, the cultures which received the carcinogen showed a striking retardation of the rate of increase in the diameter of the cultures when compared with control cultures. This retardation was quite comparable to that shown in chart 2 for series 188. In spite of this retardation in the rate of increase in the diameter of the culture frequent mitoses were observed. As with series 188 and 191, growth was very dense. The cell forms and characteristics were quite similar to those observed for series 188 and 191.

Except for the loss of a few cultures from this series as a result of accident, all cultures survived until this first transfer. Later subculturing, with division of the cultures, increased the length of the series substantially and could have increased it even further. Owing to limited facilities for handling large numbers of cultures this series

was later reduced to about 10 cultures, all derived from a single original culture.

While the increase in diameter of all of these cultures was slower than that of the controls, it was still sufficiently rapid that cultures were routinely obtained from which 8 healthy explants could be cut.

Since this series was still being carried in methylcholanthrene at the time it was closed owing to bacterial infection, it will not be considered further. Insofar as this series was followed it apparently ran an identical course with series 188 and 191.

### HISTORY OF SERIES 191

Series 191 consisted of stock fibroblasts of subcutaneous origin. This series followed a course generally parallel with that of series 188 and 189. After addition of the carcinogen to the cultures there was some degeneration within about 30 days. From this time on through the first transfer generation the diameters and densities of the cultures were substantially less than of the controls. Mitoses were sometimes observed but were not studied closely.

These cultures were transferred to fresh flasks at different intervals from 88 days after the carcinogen was first added. In these new flasks, except for the 2 cultures noted below, the carcinogen was continued. In chart 1 the set of cultures which was continued in carcinogen is designated as 191–B. In this second transfer generation and in later generations in the presence of methylcholanthrene the culture diameters, as in series 188 and 189, increased at a rate slower than those of the controls. In these carcinogen-treated cultures the cell density was substantially increased. As with the earlier series the presence of extensive necrosis was less prominent than during the first generation in all cases where cultures were transferred to new flasks at least every 15 days. For freshly transplanted cultures there was little marked degeneration in the zone of migrating cells.

At 55 days after first addition of methylcholanthrene to the cultures, the carcinogen was omitted from one culture, No. 5. From that time on and in subsequent transfers no more carcinogen was added to this culture. The course of this culture is shown in chart 1, set 191–55. This culture strain continued to show recognizable lateral adhesion of the cells 170 days after the addition of the carcinogen was discontinued. At 145 days after the first addition of the methylcholanthrene, culture No. 23 of set 191–B was subdivided into 6 cultures. Of these, 3 were carried on in the carcinogen as a group of set 191–B, and 3 were removed from the carcinogen and were thereafter transferred with no further addition of carcinogen. These 3 are designated in chart 1 as cultures 191–146. These cultures, all originally from culture No. 23, totaled 22 at the time the series was closed

because of bacterial infection. Of these, roughly half were being carried on in carcinogen, while the other half received no carcinogen after 146 days. Up to the time the series was closed, that is, 250 days after first addition of carcinogen to the cultures and 105 days after addition of carcinogen was discontinued in half the set, no marked difference could be detected between cultures of the two halves of the set. Both halves were radically changed from the controls.

The following comparison may be made of the carcinogen-treated cultures of series 188 with those cultures of series 191 which were removed from the carcinogen after 145 days and then carried 90 days in culture media to which no carcinogen was added.

1. While actual growth curves were not made, it appeared that the rate of increase of the diameters of these cultures from series 191 was even slower than that of any of the other carcinogen-treated cultures. It was certainly slower than that of any of the control sets. In fact, for the first 30 days after removal from the carcinogen doubts were experienced as to whether the strain would continue to live. Later, however, the growth rate seemed to improve slightly.

2. Carcinogen-treated cultures of series 188 had a definite tendency toward lateral cohesion with resultant formation of cell ribbons and sheets of limited area. Many loose cells were seen at the edges of some cultures, though these cells did not show long terminal processes. In this set of series 191, however, the tendency to lateral adhesion was far more exaggerated. Extremely few loose cells wandering out from the culture were seen. All cultures showed one, or both, of two general types of architecture. The less frequent of these types is shown in figure 16 and consisted of an interlacing meshwork of cells, probably a modified form of the cell ribboning seen in the earlier cultures. In figure 17 is shown the more typical, and generally the only, type of architecture seen in the cultures. The growth here was generally that of a very closely fused epithelial sheet. Even when clumps of cells had floated loose from the main clump and had re-anchored themselves on the surface of the clot at a distance there was an almost complete absence of spindle forms. In all instances the cells were sheet-like, coherent. The photographing of these cells was quite difficult owing to the fact that they were spread out so thin that their edges formed very poor refractive images. These two forms of cell growth were not limited to the fluid interface of the clot; they were of regular occurrence both on the glass and fluid interfaces and also within the body of the clot itself.

3. The prevalence of central necrosis in the culture after about 15 days was at least as great as that in the carcinogen-treated cultures of series 188 and was far more accentuated than in the controls of either series.

4. The tendency of the cells to show increased granulation appeared quite as accentuated as in the carcinogen-treated cells of series 188, but not more so. They possibly showed fewer fat droplets.

5. In an examination of the carcinogen-treated cultures of series 188, all appearances of the cultures suggested that the carcinogen-treated cells were far more labile organisms than the cells of the control cultures, and were quite similar in this respect to those of the carcinogen-induced sarcomas studied in the rat. With cultures of series 191 this increase in lability appeared even more accentuated. Aberrant cell forms were more common at earlier stages after transplantation to fresh flasks. There was also more diffuse necrosis at earlier stages.

6. In both series numerous mitoses were observed.

It may be noted that although the controls of series 191 showed just a trace of lateral cell cohesion, which was almost certainly due to traces of contamination with methylcholanthrene from the glassware, nothing like the degree of change observed in the cultures deliberately treated with carcinogen was ever observed in the controls.

One point is of marked interest in connection with both series 189 and 191. In both of these series the cultures that were treated with the carcinogen showed at all times loose crystals of methylcholanthrene lying around, through, and on the plasma clot of the culture medium. While in the early stages of the cultures subjected to the carcinogen there had appeared a degenerative action of the carcinogen on the cells, in the later stages it was the usual thing to see these carcinogen crystals in close juxtaposition with, or surrounded by, cells which were quite as healthy as other cells situated at a distance from the crystals. Further examination of the cultures showed numerous cells which actually contained crystals of the carcinogen. In one instance a cell was seen with a crystal the length of which was roughly four times the diameter of the average cell in the culture. The cell which surrounded this crystal was much larger than usual. It showed a clear periphery with a very granular cytoplasm just surrounding the nucleus and the crystal. The relation of the crystal and the cell was so clearly defined that there could be no question that the crystal lay actually within the cell itself.

## DISCUSSION

Creech (*2*) studied the effect of methylcholanthrene and of 1:2:5:6-dibenzanthracene choleic acid on fibroblasts of the tissue surrounding the ribs of embryonic mice. For each cubic centimeter of culture medium 0.01 mg. of carcinogen was used. The cultures were grown in hanging drop preparations in chicken plasma, chick embryo extract, and saline. Cultures were studied at 44 to 45, and at 70 hours. The relative areas of the cultures studied were determined and the number

of mitoses counted. Controls were carried in the noncarcinogenic hydrocarbons, phenanthrene choleic acid, and acenaphthene choleic acid, in desoxycholic acid, and with no hydrocarbons. Within the short period studied there was found a marked increase in the outgrowth of cells in cultures which received the carcinogen. Chromosome abnormalities were also reported in detail. From our own data during the first 2 or 3 days of culture no such stimulation as Creech reported was observed.

Mauer (*7*) studied the action of 3:4-benzpyrene, 1:2-benzanthracene, 1:2:5:6-dibenzanthracene, and 20-methylcholanthrene on chick fibroblasts taken from the pectoralis of 10- to 14-day chicks. These cells were cultivated in chicken plasma and chick embryo extract. In concentrations of 1/40,000 and 1/400,000, respectively, he found growth noticeably retarded in the carcinogen cultures at 1/400,000 in 20 days (7 to 8 passages), while in the 1/40,000 concentration the retardation was noted in from 4 to 5 passages. There was also marked degeneration from the carcinogen. Mauer noted many abnormal cell forms and abnormalities in cell cleavage. These findings coincide with our own. No attempt was apparently made in either Mauer's or Creech's work to control the action of light on the cells.

The results reported in this and the preceding article (*5*) have shown a definite initial retardative effect of methylcholanthrene on the growth of rat fibroblasts and on 3 different strains of intramuscular and subcutaneous mouse fibroblasts. The carcinogen also had a definitely injurious initial effect on these various cells. This effect was quite striking in a series of rat cells subjected to white light. It was less noticeable but definitely present in the 3 series of mouse cells not subjected to white light but handled in light of 480 m$\mu$ wavelength or longer. In spite of this initial retardative and toxic action these cultures continued to live in a culture medium saturated or nearly saturated with carcinogen and continued to grow under these conditions for extended periods of time, certainly for as long as 265 days. From all indications this growth would persumably have continued much longer or indefinitely.

That the greater success in the growth of these series 188, 189, and 191 of mouse cells was due solely to shielding them from white light is unlikely. Nor is it probable that this greater success was due to the use of mouse tissue instead of the rat tissues which were used in the earlier series. Our cultural conditions in the absence of carcinogen have grown either type of tissue with equal facility. Another factor which probably played a large rôle in the satisfactory growth of these cultures in methylcholanthrene is that while in the early series of rat-tissue cultures an attempt was made to transfer the cultures into fresh flasks about every 10 to 15 days, in these last 3 series of mouse tissues much longer transfer intervals were used. In view of the

severe retardative action of methylcholanthrene on the growth of the cultures the old transfer time of 10 to 15 days was almost certainly insufficient to allow the cultures to compensate fully for the loss of cells resulting from such transfer. The result was that at each such transfer the culture became progressively smaller. This is particularly well exemplified in series 176, set A (see ref. (*5*), page 378, chart 1). With series 188, 189, and 191 the experience previously acquired in handling strip cultures (*3*, *4*) allowed the use of such cultures and permitted them to be carried uninterruptedly in the same flasks for more than 100 days. This eliminated loss of cells resulting from frequent transfer. In view of the marked necrosis and the clouding and disintegration of the clot after about 90 days, more satisfactory results would probably be obtained if the cultures, while in methylcholanthrene, were transferred about every 60 days.

While the results obtained have shown that under the experimental conditions used methylcholanthrene had a definite initial retardative and injurious effect on the cultures, its later effect is not so easily interpreted. With reference to this later action there seems to be no question that the carcinogen definitely caused a retardation in the rate of increase in the diameters of the cultures subjected to it, and that this retardation persisted after the carcinogen was omitted from the cultures. The cell density, however, was far greater than the density of the controls. In view of this increase in cell density, the relative diameters of the control and carcinogen-treated cultures are no accurate criterion of their relative actual rates of growth. While, therefore, the first effect of the carcinogen on the culture was to cause retardation of growth, present data do not justify a conclusion as to whether this retardation continued or finally gave way to an acceleration of growth. This point must remain for further study. It should be emphasized, however, that there was a definite change in the character and type of growth.

The $C_3H$ strain of mice used in this study has proven itself quite susceptible to the action of methylcholanthrene *in vivo*, as mice of this strain have shown tumors at the site of intramuscular or subcutaneous injection with great regularity (*1*, *8*). For instance, at about the same time series 188 was started in this laboratory, Dr. E. W. Wallace, in the course of some of his own work, injected 20 such mice, some intramuscularly, some subcutaneously. Each mouse received 2 mg. of methylcholanthrene in lard. All of these mice developed tumors at the injection sites in from 80 to 105 days.

Shear (*8*) found that methylcholanthrene crystals without lard exercised a carcinogenic action in a time comparable to that required when the carcinogen was injected in lard. We are probably justified in assuming that these crystals dissolve in the surrounding tissue fluids to create, directly around the crystals, an area or field of fluid

more or less saturated with the carcinogen. Under the conditions we used in tissue culture the medium was also essentially saturated, or very nearly saturated, with the carcinogen. If other conditions were as favorable *in vitro* as *in vivo* it would appear that in carrying a strain of cultures in the carcinogen for as long as 114 days, as in series 188, or 145 days, as in series 191, the cells of the cultures would have had ample time to assume changes of a malignant nature. It is, therefore, significant that while the cells of series 191–55, exposed to carcinogen for 55 days, showed only very slight cohesion, the cells of series 188, exposed for 114 days, showed clearly defined changes, while the cells of series 191–146, exposed for 146 days, showed even more extreme changes. In other words, the cells in the culture were undergoing definite changes at a time when *in vivo* the tumors would have been appearing. This observation, together with the fact that nearly all the changes observed in the cells *in vitro* were such as to make the cells more closely identical with the tumor cells induced by methylcholanthrene *in vivo*, seems to show that *in vitro* we have, to at least a certain extent, reproduced the *in vivo* action of the carcinogen.

At about 83 days after the carcinogen was omitted from series 188, each of 12 mice was injected with one culture of this series. While these mice were held far in excess of 120 days they never showed any signs of tumor. For the final recognition of the malignant cells, with our present inadequate criteria, it is necessary to rely on the production or nonproduction of tumor at the site of inoculation of the cells. The present results, therefore, furnish no conclusive evidence that the transformed cells resulting from the action of the carcinogen on these fibroblast cultures were malignant. However, so far only 12 mice have been injected and this number is too few for a conclusive result. Another complicating factor at present impossible to evaluate is that these injected cultures had been grown for more than one year in an entirely foreign culture medium (mouse cells in horse serum and chick embryo extract). What adaptation is necessary to reintroduce them to their normal *in vivo* medium we do not at present know. It should be emphasized, however, that although this final proof of the malignant nature of these cells treated in tissue culture with methylcholanthrene is lacking, in their morphology and in their cultural characteristics they have undergone changes which bring them recognizably closer to, and in many features identical with, the malignant cells which we have studied in tissue culture from tumors which arose in rats following subcutaneous methylcholanthrene injections. In other features, as, for instance, in the extreme cohesion of the cells, it is possible that the change *in vitro* has gone even further than the *in vivo* change. Further, all of these changes, while tending to produce a cell type simulating to a great

degree the *in vivo* induced malignant cells, have also certainly tended to remove the *in vitro* treated cells from the cell type of the normal fibroblast from which they arose.

In all of these studies great care was taken to try to keep the glassware free from any chance contamination with carcinogen. This was apparently successful up until about 45 days before the series was closed. At no time did the controls of series 188 ever show any evidence of carcinogen action. This series of cultures was always run entirely separate from the others in order to avoid any chance of cross contamination. At about 45 days before the series was closed, however, the controls of series 189 and 191 showed a trace of lateral cell adhesion. This was sufficiently pronounced to be easily recognizable. At the same time it never even approximated the degree of that seen in any cultures that were deliberately treated with carcinogen. These controls of series 189 and 191 were being carried on in a group of cultures which was receiving high concentrations of carcinogen three times a week. As a result of this apparent contamination of the controls of series 189 and 191, a close examination of the whole tissue culture technique revealed a number of points which could have, and almost certainly did, let traces of carcinogen through into the controls of series 189 and 191 during the last 45 days of culture. There was far less possibility that traces of the carcinogen could have gotten through into the controls of series 188. If any carcinogen did get through into these controls, it was certainly insufficient to cause any recognizable change in the cells.

The cells which were treated with methylcholanthrene have shown a series of very clear and characteristic changes. These changes have been so fundamental as to alter not only the morphology of the cell but clearly to alter the morphology and the physiology of the cell and the culture. This has occurred in the tissues studied from 3 different mice, in cells from both subcutaneous and intramuscular origins. The alteration has persisted for a long time after the carcinogen was omitted from the cultures.

No control cultures of series 188 ever showed any action of the carcinogen and all cultures of the series were transferred separately from those cultures which received carcinogen. It therefore seems unlikely that a significant concentration of carcinogen could have crept into this series after the intentional addition of carcinogen was discontinued. Further, after the intentional addition of methylcholanthrene had been discontinued the cultures were transferred into fresh flasks from 12 to 15 times. They were soaked with from 1 to 2 cc. of saline more than 100 successive times for 1 hour each, and were soaked from 1 to 3 days each with more than 100 changes of 1 cc. each of fresh fluid culture medium. In spite of all this the changes produced by the carcinogen persisted for as long as the cultures were

carried, that is through 265 days after discontinuance of the carcinogen additions. Further, during the last 200 days of this time there seemed no further progressive or regressive change in these cultures.

The conclusion is obvious that during this time there could have persisted in these cultures only infinitesimal traces of carcinogen. Until we know definitely more concerning the action of such extremely minute traces we cannot exclude the possibility, seemingly slight though it is, that these traces may have had some rôle in preserving the changes induced in the cells by the higher concentration. This possibility is also suggested by the work of Hollaender, Cole, and Brackett (*6*) of this Institute, who found a definite action of methylcholanthrene on yeast in a concentration as low as $10^{-8}$ or $10^{-9}$. In the dark this effect was stimulative; in light the effect was injurious. Unless there was a persistence of activity of the methylcholanthrene in the extremely slight traces probably left in the treated cultures of series 188, it seems that the change which the carcinogen produced in the cells was a permanent one and one which continued relatively unaltered through subsequent generations of cells.

While some nuclear changes have been noted in these carcinogen-treated cells, studies on this point are as yet too incomplete to justify any conclusions. The outstanding changes observed have been those relating to cell form, shape, size, granulation, and, most remarkable of all, cell cohesion.

The increase of cell cohesion has been so striking as to justify some emphasis. This phenomenon, as well as the flattening of the cells and the rippling of the edges of the cells, strongly suggests fundamental changes, direct or secondary, in the cell membrane. That this is one site of localization of the carcinogen within the cell is suggested also by the fact that methylcholanthrene and other carcinogens are readily lipoid-soluble, while the cell membrane is rich in lipoids. Data available do not justify a conclusion as to whether the observed changes which seem to have resulted from a change in the cell membrane have any direct connection to the assumption of malignancy by the cell.

In the previous article (*5*) it was reported that particularly in the early life of cultures of series 186, less in the early life of cultures of series 188, there was a general tendency for the cells to migrate, as usual, radially from the center of the culture, but to arrange themselves circumferentially at the edges of the cultures. The question is raised as to whether the occurrence of this unusual orientation is not related to the various other observed changes apparently relating to surface membrane changes in the cells.

In this action of the carcinogen on the cells in culture, some cells, as stated, died. It appeared, however, that the cell type or types which finally dominated the cultures did not come from just one or two limited centers in each culture. It appeared rather that the

carcinogen was altering almost all, or all, of the cells in the culture, and that while some of the cells were unable to live, the majority of cells in the culture, or at least a great fraction of them, were altered and came through alive and in modified form.

It is of great interest that the action of this carcinogen on these cultures was apparently progressive with time. For instance, in series 191 at 55 days there was just a trace of cell adhesion, although this persisted after removal from the carcinogen. At 114 days in series 188 the characteristics of the cells were clearly and permanently altered in such a way as to show a progression of the increased cohesion of the cells seen at 55 days, while in series 191, held for 145 days in the carcinogen, this action of the carcinogen had resulted in even further alteration of the cells. This further alteration manifested itself in greater cohesion and more plate-like cell shapes. At no stage in the series of studies made have there been any suggestions seen of sudden alterations in the cultures. Rather it has appeared that after the initial stages of severe toxic action of the carcinogen, there followed gradual and progressive alterations in the cells of the cultures. In some instances these alterations resulted in such aberrant cell forms that they did not survive. In the main, however, there resulted cells radically and apparently permanently changed from the cells from which they arose and yet able to live and grow rapidly in the culture medium used.

Another extremely interesting point is the fact that the longer the cells were subjected to the carcinogen the more closely they seemed to simulate epithelial cells in their manner of growth. Even at 114 days the similarity was quite striking, while at 145 days the cells were often far more easily classified as epithelium than are, for instance, the epithelial cells of the Walker mammary carcinoma 256. The significance of this morphological similarity of the carcinogen-treated fibroblast to the epithelial cell is not clear. It is a point, however, which should not be lost sight of in the study of both carcinogenesis and of tissue organizers.

It is natural that in considering the radical changes induced in these cultures which were being treated with methylcholanthrene, the question arises as to whether or not the changes induced could have occurred from some uncontrolled agency other than methylcholanthrene. In order to rule out any possibility of this it can only be said that great care has been taken to try to eliminate such sources of error or uncertainty. The purity of the methylcholanthrene has already been discussed in the preceding article (*5*). The possibility of any contamination of the cultures with cells from tumor cultures or the possible inclusion of a tumor culture in the methylcholanthrene series through confusion of a culture label or through other error has been entirely eliminated through the fact that during this whole study on the action

of methylcholanthrene on the cultures of series 188, 189, and 191, no other cultures of any type, tumor or otherwise, have been handled in any way in the whole laboratory suite in which these studies were being carried on or by the operators concerned. Further, the actual handling of every culture has been done by only one operator (W. R. E.) while the preparation of all culture glassware and solution has been carried on completely within the one tissue culture suite. While of course it has been impossible to preclude the activity of some chemical or virus-like body which could have persisted in the laboratories from former handling of tumors, or which could have gotten in from other rooms, such speculation is entirely beyond the scope of this present study.

## SUMMARY

1. The action of methylcholanthrene has been studied on 3 series (numbers 188, 189, and 191) of tissue cultures of fibroblasts from different adult $C_3H$ strain mice. These 3 strains were subjected to 0.01 mg. of carcinogen per 1.0 cc. of culture fluid. The carcinogen was added to the culture fluid as a fine suspension.

2. The initial effect of the carcinogen was toxic and retardative for growth. Present data do not preclude the possibility that this was not later superseded by some stimulation of growth.

3. The cultures of series 188 were carried in the carcinogen for 115 days. The carcinogen was then omitted and the cells carried for 265 days in fresh culture medium. Even after the carcinogen was omitted and the medium had been changed more than 100 times, so that the residual carcinogen concentration was certainly extremely low, the radical changes observed in the cells persisted. These changes are described in detail.

4. The changes seen were in general confirmed by the second series, 189, but the cells of this series were not carried sufficiently long after addition of carcinogen had been discontinued to be considered more than confirmatory.

5. Series 191 was carried for 146 days in carcinogen, then in fresh culture medium for 104 days. Active traces of carcinogen remained in this series due to contamination of the culture glassware. The changes seen in this series were similar to those observed in the other series, but showed to a more exaggerated degree. They are described in detail.

6. In all cultures studied there was no sign of a sudden change in the culture from the action of the carcinogen. There seemed to be rather a gradual change which progressed with time.

7. Similarly, this change seemed to affect all, or at least the larger number, of the cells in the culture. There was no evidence that one

cell or one small local group of cells was transformed and that these overgrew the other cells in the culture.

8. With the exception of an epithelial-like sheet formation by the treated cells, all the changes observed tended to make the treated cells to a great degree like cells which the authors have studied in tumors which have arisen in rats from the injection of methylcholanthrene. The tendency has also been to make the treated cells strikingly different from the normal fibroblasts from which they arose. In regard to the epithelial-like sheet formation noted, while some of this has been seen in a strain of methylcholanthrene-induced tumor cells studied, the cohesion did not appear in as exaggerated a form as in some of the *in vitro* treated cultures. The suggestion is made that in this respect the cells may have gone even farther *in vitro* than they did under the action of the carcinogen *in vivo*.

9. Twelve mice were injected with carcinogen-treated cultures from series 188. The mice showed no tumors. The results are considered as inconclusive for reasons discussed.

10. It is emphasized that the chief changes observed in the cells seem to center around a change, either primary or secondary, in the cell membrane. The question is raised as to how crucial a change this is in the induction of malignancy in the carcinogen-treated cell.

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# OUR VERBAL PUBLIC HEALTH ACTIVITIES [1]

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It seems to me highly desirable, since speech can so easily lead us into routine talkativeness, that we occasionally take time out to review our many word-of-mouth activities. Ever since public health work began expanding from merely regulating for health to include educating for health, it has year by year increased its teaching staff and added to the verbal content of its programs, until health instruction now ranks as one of our major activities. In fact, practically all our efforts have educational potentialities.

All public health workers are to some extent educators, but the public health nurse is the one on whom we rely chiefly for carrying out the biggest share of our program of instruction. These nurses on the whole spend more of their home-visiting time in teaching the subject of health than they do in actual nursing services. Our clinics, too, are centers of education, most of them having all the characteristics of an educational conference, with the nurse and physician as paid speakers on general or particular topics of health. Even those clinics organized for some specific service, such as immunization or venereal disease treatment, contribute to the information and experience of those who attend. The mothers' clubs run in connection with many prenatal clinics may differ in subject matter from the local Shakespearean Study Club but they have the same general objective. And so it goes. Even the sanitation officer, who once directed himself almost exclusively to law enforcement, has now become a lecturer on the more sanitary life. With all this instruction so prominent a factor in our public health endeavors, it behooves us to pause now and then to take stock of what it is we are saying. To this end the United States Public Health Service has undertaken a series of studies designed to evaluate educational effort, especially the spoken word, as used by nurses, sanitarians, and clinicians attached to health agencies.

This particular discussion has to do with what the nurses are saying. No less an authority than Dr. Haven Emerson places the responsibility for the success or failure of our educational program upon their shoulders. "The most effective permanent educational service for health," says Dr. Emerson, "is that delivered in person and by word of mouth by the public health nurse to the family in the home."[2]

This is the theory on which most health agencies are proceeding, and they are of course staking a great deal in time, money, and

[1] Presented at the Sixth Pacific Science Congress, Western Branch, American Public Health Association, Oakland, Calif., July 25, 1939. Part of a symposium on "The Spoken Word as a Method in Health Education."

[2] Emerson, Haven: Scope and form of local official health services with particular reference to the city of New York. N. Y. State J. of Med., 38: 796-802 (May 15, 1938).

expectations on these instructive home visits. When you consider that there are in our country about 20,000 nurses setting out daily on these home calls, and that most of them are required to do more teaching than actual nursing of the sick, the size of our investment in health education is obvious.

This being the situation, one of the most vital considerations in the whole public health movement is the effectiveness of the home instruction. Many administrators express the fear, with more or less definite instances in mind, that it is not adequate instruction. Many supervisors have witnessed home teaching which was not fitted to the situation. Many nurses will protest that it was an ill day when they had to change from nurse to teacher of health. The National Organization for Public Health Nursing in its Survey of Public Health Nursing [3] has set up a table of comparative ratings according to which the nurses reveal upon analysis less aptitude in their teaching activities than in their other duties.

It would be naive to complain simply because the nurses did not turn out to be superlative teachers. Why should they? What could be more logical, educationally speaking, than that a group who chose to be nurses should do better at nursing than at teaching? Convinced though we are that education is a highly necessary public health measure and that the nurses going into the homes have the finest sort of opportunity to carry on this education, we cannot lightly dismiss the fact that the nurse has been trained to minister to the sick. This is her chosen profession. Some nurses will tell you that they chose nursing in preference to teaching. At any rate, it is probably safe to assert that few of those women who decide to become nurses realize beforehand to what an extent public health nursing has become identified with education, or know that if they should join the staff of a health agency they will be asked to teach more often than to nurse.

This is not a circumstance that should persuade us to eliminate our instructive program, but it is a circumstance to be taken into account. We cannot change the fact that the nurse was educated for nursing rather than for teaching, but it is true that with her manifold contacts from home to home she is a logical public health educator. What we need to do is to study her instruction closely and try to revamp it, to build it up or pare it down, as may be necessary, to the end that it may be meaningful and useful and have nothing in it of settled routine or of talk that does not fit the case.

One direct method of studying the instruction given, and one which the Public Health Service has been using, is to take stenographic records of home calls and to supplement these verbatim accounts of

[3] Survey of Public Health Nursing. Katharine Tucker, general director, Hortense Hilbert, assistant director for the Survey. The Commonwealth Fund, Oxford University Press, New York, 1934. Page 206.

visits with the service records of the cases. We have done this for some 1,200 instructive home calls, and the resulting material has provided us with excellent data for discussion. These data are revealing upon analysis what we had desired to find—the reasons why the nurses do not succeed as well in their educational work as in their other activities.

The data give evidence, for one thing, of the fallacy in the current system of individualized instruction, of expecting the nurse to determine what should be done rather than to carry out the orders of physician or clinic. Public health nursing was designed originally to complement clinic service. Between sessions of the clinic the nurse would visit the home, in some instances to assist the family in carrying out the regimen prescribed at the clinic and in others to make field observations that might help the clinic physician to understand the circumstances surrounding the patient. But the emphasis has shifted from year to year, and the nurse working for an official health organization today is pretty much of a free agent, free to define her own job, to locate her clientele, and to decide what should be done under a wide variety of circumstances.

As the system works out, the nurse makes a relatively small proportion of her calls to carry out a particular assignment on the dictates of the physician or clinic. Bedside nursing visits are, of course, something else again; on such calls she is usually discharging certain duties in line with her nursing training, but these time-honored functions of the nurse do not come within this discussion.

Since the type of situation which the nurse selects for her calls is likely to be one in which medical advice figures, and since her training has been to care for persons under medical advice, it is not surprising to find her saying again and again: "See a physician." The value of such instruction is debatable, and when it is prolonged or repeated many times it is highly debatable. Almost every person who experiences untoward symptoms and possesses the money or the credit for a physician's advice will consult a doctor. If he hasn't the will to go, he probably has a sister or a mother or a neighbor to persuade him. If, however, he has neither the funds nor the credit, and if the community does not provide free facilities, then telling him that he should see a doctor amounts to a waste of time and of public funds. Yet the nurse frequently has no other practical advice to offer.

A similar stalemate results between the nurse and the household when the nurse has to say that she is not allowed to give some explanation in answer to their questions. Here, for example, is a tuberculosis call where the nurse must acknowledge the limitations of her teacher's permit and refer the family to the physician for an explanation of terms. The woman has asked regarding her husband, "Do you know if he is cured?"

NURSE. The doctor at the clinic would have to tell you that.

MRS. Chronic doesn't mean cured, does it? When I saw the letter, it says "chronic pulmonary tuberculosis." What does that mean?

NURSE. The doctor will have to interpret those things. I'm only a nurse and I'm not allowed to.

This is rather a paradoxical educational call, with the teacher falling back upon her position as a nurse in explanation of her inability to explain.

On the other hand, the nurse who is free to give a direct answer such as this, "Arrested means that the disease has been stopped, but it doesn't mean that he can stop being careful," is in a much more useful and much stronger position.

In the next quotation the nurse is explaining her calling to the patient:

"The visiting nurse takes care of you when you are sick. We come in to give you a lot of advice, and then tell you from time to time what to do in particular difficulties."

But what an infinitely better emissary of public health is the nurse who can say:

"Wouldn't you like me to give you a bath? You will feel so much better, and then we can discuss any health questions you may have."

Here is another illustration to show lack of substance in the spoken word as used on many of these calls:

NURSE (to a prenatal case). Did they tell you to take any care of them (the nipples) at the hospital?

MRS. No.

NURSE. They probably will the next time.

One could hardly blame this woman in the throes of maternity if she wondered why the nurse came into her home to bring up subjects and let them drop.

Another nurse on a postpartum call, using a homely analogy, gives the required instruction in a few brief sentences:

"Now you wouldn't want to drink out of a dirty cup, would you? Well, your nipple is the baby's cup. And that's the reason we're fussy about keeping the nipples clean."

The colloquial tone may not be suited to every call, but the clever nurse will adapt her instruction to the type of patient. The important point is to give the necessary information.

This next visit is to a woman who has been in bed for three days with a sore throat, unable to care for her month-old baby. The visit covers an interchange of some 89 remarks between patient and nurse, out of all of which the nurse may be credited with two efforts to meet the needs of the household. These two consist of a recommendation that a physician's advice be sought and a promise to send the visiting nurse to care for the baby and the mother. The sum total of the

nurse's activity here in the face of acute need is expressed in her last speech:

"Then send him (the husband) down to the home relief and they will send a doctor. I hope you feel better. I will send the visiting nurse in to take care of the baby, and don't forget to send your husband down to the home relief."

In case you object that the data seem critical, my defense must be to quote the first person who remarked, "The record speaks for itself." And in case you accuse me personally of being too critical, let me protest my sincere interest in the value of sound health education. My point is that the possible results are so great that it seems a shame to miss them by spreading the instructive work too thin.

It is not necessary that these results be missed. Certainly there are plenty of situations on which to work, there is much instruction to be conveyed and personal service to be rendered, and we have thousands of persons already hired and on the job. The problem is how to fuse these various elements. If time permitted I could detail a tuberculosis call on which the nurse through her recorded words can plainly be seen as the agent of the clinic carrying on its work in the field. The content of her visit is cut to fit the situation, but it is consistently held to the objective—to convey the information necessary to supplement the services of the clinic. A summary of the visit will show how instruction may be pointed to the end in view.

The tuberculous patient is in a late stage of the disease but has only recently gone to the clinic and had an examination. The nurse, addressing herself to the patient and his wife, instructs them in the use of tissues for his sputum, the disposal of the tissues, and the reasons for this care; shows them how to keep fresh air circulating through the room without causing a draft; explains the necessity of keeping the patient's dishes separate and of boiling them; advises fruit for his constipation; pictures a bare clean floor as unsafe for germs; tells the wife that for the protection of the household she must use a disinfectant after caring for the patient; emphasizes the necessity of isolation and shows how it may be accomplished in that situation; and gives the day and the time that the patient may attend the chest clinic.

It is quite apparent all through the transcript on this call that the nurse is keeping the purpose of her visit well in mind. She has come to the home to teach the family the importance of cleanliness, fresh air, isolation of the sick, precautions against the germ of tuberculosis, and not only to teach them but to show them how these things may be accomplished in their circumstances. Her instruction is brief and colloquial but connected and to the point. Her words are adjusted to the understanding of the family but without sacrifice of scientific accuracy, as shown by this paragraph:

"If he leaves something on the plate, if he leaves a piece of meat on the plate—we always say it's a sin to burn food but it isn't any sin to burn germs, hear? Because you're destroying germs when you burn them. You want to take this food he leaves on the plate and burn it; burn it up right away. Put it right on the fire; fire destroys germs. Boil his dishes first, and after you boil them, wash them with soap and water, and then keep them in a separate place. I guess you could keep them in here."

I am not suggesting the curtailment of the teaching functions of the nurse. As liaison officer between the physician or the clinic and the patient she has many tasks to perform which contribute to a well-rounded and smooth public health program. But in those cases where the choice of calls has been made on nothing sounder than routine visiting of a tuberculosis case every month or three months, or an infant hygiene case once a month, you are going to find much perfunctory and ineffective instruction. Our data show calls on which the nurse out of her store of book learning would proceed to instruct a mother in how to bring up her child, while the woman would listen politely and patiently but with an air of criticism for such a system of home visiting. That is to say, her remarks as they stand in the record would lead the reader to assume that her attitude was one of politeness, patience, and criticism.

On one such call the nurse asked concerning the sleeping hours, the food, the weight, the habits of the child, and so on, to all of which questions the mother gave courteous answers but of such a nature as to show very plainly her opinion that she could manage her own home situations. Finally she asked, "How do they decide what cases to look up?"

Another type of misspent call revealed by our data is that in which the nurse has not learned her lesson well enough to be teaching, or has not learned how to cut it to fit her client. If a patient stops a course of treatments because her arm swelled (as did a patient in our data) and is told by the nurse, "The doctor had to have the reactionary measure to know the physiological effect on your body," she is likely to be more confused than satisfied by the explanation.

But in the next quotation the nurse in discussing the Schick test is talking sense according to the comprehension of her patient:

"Then depending on your doctor's advice—it may be 6 weeks or it may be 6 months later—he should have a Schick test. It is a simple little skin test. The doctor injects a little medicine under the skin, and then in 2 or 3 days the doctor looks at that and he can tell if the diphtheria material is actually protecting the child against the disease. That is the reason for giving the Schick test. You know, to see if the child is actually protected."

An error common to almost every educational service is the reiteration of stock precepts. In health education the one regarding drinking milk is one of the commonest. Here is an example from our data:

NURSE. Is your appetite pretty good?
MRS. Sometimes.
NURSE. Are you drinking milk?
MRS. No, the doctor said not to. He wants to dry up my breasts.

This last example brings up the point I wish particularly to make. The weaknesses are the fault of the system more than they are the fault of the nurses. Poor administration is a cause of many errors. Lack of coordination between the clinic and the field nursing service is another. One cannot expect the nurse to be psychic about the clinic experiences of the patient. If the information is not on her record, and not otherwise provided her, she is bound to go into the homes asking unnecessary questions. Our data show her doing that again and again, perhaps urging the patient to go to the clinic when he has been there not 2 days since. Or she might be calling to discuss, and presumably to remedy, the nutritional disorder of one of the children, with apparently no clue given her as to whether the condition is one of faulty diet or of endocrine disturbance. Our data show one nurse saying, "Lie down in the morning and afternoon," and the patient contributing something more to the point, "The doctor told me from 2 to 4 was the best hours." And judging from the records, the two precepts of "eat more vegetables" and "drink more milk" seem to be considered pertinent advice regardless of the physical condition of the patient or the financial condition of the household.

The data clearly show us that much of the vital force of public health is misspent. Here are 20,000 nurses, a great potentiality for health education. But the possibilities of this corps will never be realized until there is a general tightening up in the system of distributing their services. A more accurate relationship between the physician and the patient or the clinic and the patient through the medium of the nurse will give a new value to the job.

In closing I would like to restate my approach. It seems to me that the time has come to evaluate the spoken word, and this I have tried to do out of the fullness of our data. This discussion is by no means offered as an analysis of bedside nursing, of clinic services, or of those liaison duties by which the nurse makes the clinic comprehensible to the patient and the patient amenable to the clinic. Such services are implicit in it, of course, because in greater or lesser degree their results are bound up with the achievements of health education.

In the various analyses of our data on the content of health education, the results of which will be published as they are completed, one idea becomes increasingly clear, and that is that individualized instruction to be good must be highly specialized. It must be teaching suited to the person, his circumstances, and his symptoms. It implies an examination by one competent to make it and to give the necessary recommendations. Individualized instruction is expensive. In say-

ing that I do not decry its necessity, but only protest against carrying retail to the patient that general instruction which could be sent wholesale.

The theory behind home visiting is that the nurse working in the family's home surroundings may best adapt her instruction to their requirements. Her practice on many such calls, however, might be described by that homely phrase "to give a lick and a promise." And even that "lick and promise" may not be applied with the discrimination that it might be.

Far from advocating a paring down of the services now rendered, I merely express the opinion that some weeding out of this loose application of instruction is necessary to assure the stability and orderly growth of a technique which can have definite value in public health practice.

## TESTS FOR COMPLETENESS OF BIRTH REGISTRATION

The degree of completeness of birth registration in the United States and in the respective States is important to students of population, for it affects the birth rates, infant and maternal mortality rates, the computation of true rates of increase and of life tables according to certain formulas, the relative standing of various States, racial comparisons, and other related vital and demographic statistics.

In 1934, Whelpton [1] estimated the completeness of birth registration for the several States for the period April 1, 1929, to April 1, 1930, using the Foudray index, and found that the registration of white births was deficient by over 10 percent in 18 to 20 States and of Negro births by a similar percentage in 13 States. He also found that the differences in the percentage of births registered were influenced by the length of time a particular State had been in the birth registration area of the Bureau of the Census, the original birth registration States apparently recording from 97.4 to 98.1 percent of white births and from 97 to 99.2 percent of Negro births, according to the method employed in applying the Foudray index. In contrast, the 12 States admitted to the birth registration area during the period 1926–29 registered only about 85 percent of the white births and about 77 percent of the Negro births during the same period, as calculated by the same index.

A recent report issued by the Bureau of the Census [2] summarizes the findings of birth-registration test surveys conducted in Georgia and Maryland and compares the results of different methods of testing. In Georgia, 490,000 conventional birth-registration test mailing cards,

[1] Whelpton, P. K.: The completeness of birth registration in the United States. J. Am. Stat. Assoc., 29: 125–136 (June 1934).

[2] Vital Statistics, Special Reports, vol. 7, No. 60, pp. 679–695. Birth registration tests by several methods in Georgia and Maryland. By A. W. Hedrich, John Collinson, and F. D. Rhoads.

requesting a report of any birth occurring during the preceding 12 months, were distributed by carriers from local post offices. Some time later enumerators made a house-to-house check survey. In Maryland, 23,000 mailing test cards were used and the results were checked later by enumerators as well as against the reports of a preschool census of the families covered by the cards.

The surveys were conducted in cooperation with the State departments of health and were designed principally to answer the following basic questions:

1. Among which population groups is birth registration least complete?

2. How representative or dependable, for purposes of measuring completeness of birth registration, are lists of births obtained from (*a*) the conventional test card used by the Bureau of the Census and (*b*) the census of preschool children.

All birth records obtained in the surveys were carefully checked against the birth register.

The relative completeness of birth registration as found in these surveys and shown in tables 1 and 2 brings out some interesting and contrasting percentages for various population groups.

In these tables the ratios of percentages in the last column present a direct comparison of the differences in the completeness of registration found in the different population groups. The large differences shown in table 1 between cases attended by a physician and those without professional attendance, for both white and colored, might be expected. The report states that the smaller differences found between other groups are also statistically significant. For example, the difference indicated between the large-city and rural Negro groups would be expected to occur by chance only once in some millions of trials, while the smaller difference between the health-officer and non-health-officer counties would occur by chance in less than 1 out of 100 trials.

The differences between the groups were much less pronounced in Maryland, and in some instances were in opposite directions, though it is stated that the test cards as distributed in Georgia probably tended to select the higher social groups, thereby yielding a calculated completeness of reporting which was somewhat too high.

Some interesting points were brought out regarding the faults found in the methods used. Two principal factors were involved in the selection of families by the test-card distribution. One was the uneven distribution of the cards by the mail carriers, who were frequently found to have left the cards only where they had other mail to deliver. Since the poorer and uneducated families receive less mail than the prosperous and well educated, there was obviously a selection in favor of the latter class. The other selective factor was that the better

educated families, with more complete birth registration, tended to mail back their cards more promptly than did the poorer, and less completely registered, families.

TABLE 1.—*Completeness of birth reporting in contrasting population groups, Georgia (26 counties) 1934*

| Population groups contrasted | | Births enumerated | | Births found registered | | Percent registered | | Ratio of percentages |
|---|---|---|---|---|---|---|---|---|
| A. Superior registration | B. Inferior registration | A | B | A | B | A | B | A/B |
| Large city,[1] white | Rural,[2] white | 1,572 | 585 | 1,512 | 479 | 96.2 | 81.9 | 1.17 |
| Large city,[1] Negro | Rural,[2] Negro | 1,262 | 329 | 1,187 | 232 | 94.1 | 70.5 | 1.33 |
| Large city,[1] total | Rural,[2] total | 2,834 | 914 | 2,699 | 711 | 95.2 | 77.8 | 1.22 |
| Hospitalized | Nonhospitalized | 1,917 | 4,888 | 1,879 | 4,034 | 98.0 | 82.5 | 1.19 |
| Attended by physician,[3] white. | No professional attendance, white. | 2,419 | 31 | 2,046 | 19 | 84.6 | 61.3 | 1.38 |
| Attended by physician,[3] Negro. | No professional attendance, Negro. | 712 | 26 | 599 | 13 | 84.1 | 50.0 | 1.68 |
| Attended by midwife, white. | Attended by midwife, Negro. | 288 | 1,372 | 242 | 1,075 | 84.0 | 78.3 | 1.07 |
| Lived to 1 year of age | Died under 1 year of age | 6,610 | 195 | 5,763 | 149 | 87.2 | 76.4 | 1.14 |
| Educated | Uneducated | 697 | 838 | 622 | 663 | 89.2 | 79.1 | 1.13 |
| Well-to-do | Poor | 186 | 2,040 | 173 | 1,686 | 93.0 | 82.6 | 1.13 |
| White | Negro | 4,040 | 2,765 | 3,586 | 2,326 | 88.8 | 84.1 | 1.05 |
| Health-officer counties | Nonhealth-officer counties. | 893 | 2,211 | 743 | 1,745 | 83.2 | 78.9 | 1.05 |

[1] *Large city* includes 5 cities over 25,000 population: Atlanta, Savannah, Macon, Augusta, and Columbus.
[2] *Rural* means "strictly rural."
[3] Nonhospital births only.

TABLE 2.—*Completeness of birth reporting in contrasting population groups, Somerset County, Md., 1936*

| Population groups contrasted | | Births enumerated | | Births found registered | | Percent registered | | Ratio of percentages |
|---|---|---|---|---|---|---|---|---|
| A | B | A | B | A | B | A | B | A/B |
| Urban[1] | Rural | 124 | 259 | 117 | 241 | 94.3 | 93.1 | 1.01 |
| Hospitalized | Nonhospitalized | 41 | 342 | 40 | 318 | 97.6 | 93.0 | 1.05 |
| Lived to 1 year | Died under 1 year | 350 | 30 | 325 | 30 | 92.9 | 100.0 | .93 |
| Educated | Uneducated | 122 | 101 | 113 | 97 | 92.6 | 96.0 | .96 |
| Well-to-do | Poor | 25 | 241 | 24 | 227 | 96.0 | 94.2 | 1.02 |
| White | Negro | 208 | 173 | 192 | 164 | 92.3 | 94.8 | .97 |

[1] Crisfield, population 3,850.

An analysis of these birth-registration test surveys apparently indicates that, at least in the States surveyed, and probably in other States, the problem of incomplete birth registration is concerned chiefly with the less privileged families, and that the test-card method may tend to miss some of these families unless special precautions are taken.

From various studies that have been made it is evident that birth registration is much more complete in some States than in others, and that adjustments for these variations should be made in studies dealing with the numbers of births, birth rates, infant mortality, life tables, and other population statistics. The 1940 census, which will provide data for determining coefficients of correction in birth rates,

as well as for other studies of intercensal population problems, will be awaited with interest by vital statisticians and students of demography.

## DEATHS DURING WEEK ENDED FEBRUARY 3, 1940

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

| | Week ended Feb. 3, 1940 | Corresponding week, 1939 |
|---|---|---|
| Data from 88 large cities of the United States: | | |
| Total deaths | 10,161 | 9,475 |
| Average for 3 prior years | 9,705 | |
| Total deaths, first 5 weeks of year | 48,140 | 45,837 |
| Deaths under 1 year of age | 572 | 555 |
| Average for 3 prior years | 581 | |
| Deaths under 1 year of age, first 5 weeks of year | 2,761 | 2,690 |
| Data from industrial insurance companies: | | |
| Policies in force | 66,327,780 | 68,258,073 |
| Number of death claims | 13,817 | 13,336 |
| Death claims per 1,000 policies in force, annual rate | 10.9 | 10.2 |
| Death claims per 1,000 policies, first 5 weeks of year, annual rate | 10.4 | 10.1 |

# 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

### REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 17, 1940

#### Summary

The influenza situation changed very little during the week ended February 17 as compared with the preceding week, with the highest incidence still definitely prevailing in the South Atlantic and South Central groups of States. A total of 16,548 cases was reported for the current week as compared with 16,583 for the week ended February 10, and with 17,641 for the week of February 3. The number of cases reported for the corresponding median week of the 5-year period 1935–39 is 8,591, and the 5-year average is 9,932. The Mountain and Pacific States show a decline in the number of cases for the current week, while some increase is recorded for the East North Central group.

For the first 7 weeks of 1940 a total of 98,728 cases of influenza has been reported, of which 83,593, or 85 percent occurred, in the South Atlantic and South Central States, which have 32 percent of the total population.

The highest number of cases reported to date was for the week ended February 3, and the largest number of deaths in 88 large cities, as reported to the Bureau of the Census, occurred during the same week, with 10,161 deaths, as compared with 10,049 for the week of February 10, and with 9,751 for the week ended February 17.

The incidence of the other 8 communicable diseases included in the following table remained low, all of which were much below the 5-year median expectancy, except poliomyelitis, for which 27 cases were reported for the current week as compared with a 5-year median of 25.

One case of anthrax was reported in Utah.

*Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median*

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

| Division and State | Diphtheria | | | Influenza | | | Measles | | | Meningitis, meningococcus | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 |
| | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | |
| **NEW ENG.** | | | | | | | | | | | | |
| Maine | 3 | 6 | 1 | 7 | 8 | 9 | 217 | 15 | 87 | 0 | 0 | 0 |
| New Hampshire | 0 | 0 | 0 | ----- | ----- | ----- | 84 | 7 | 20 | 0 | 0 | 0 |
| Vermont | 0 | 0 | 0 | ----- | ----- | ----- | 2 | 7 | 7 | 0 | 0 | 0 |
| Massachusetts | 4 | 2 | 8 | ----- | ----- | ----- | 320 | 1,136 | 706 | 0 | 2 | 2 |
| Rhode Island | 0 | 1 | 1 | ----- | ----- | ----- | 96 | 14 | 17 | 0 | 1 | 0 |
| Connecticut | 0 | 0 | 1 | 3 | 22 | 21 | 108 | 593 | 568 | 0 | 0 | 0 |
| **MID. ATL.** | | | | | | | | | | | | |
| New York | 26 | 23 | 37 | [1]43 | [1]137 | [1]69 | 274 | 1,048 | 1,290 | 4 | 4 | 9 |
| New Jersey | 12 | 14 | 11 | 30 | 99 | 23 | 49 | 27 | 407 | 0 | 1 | 3 |
| Pennsylvania | 35 | 39 | 46 | ----- | ----- | ----- | 74 | 153 | 640 | 20 | 5 | 5 |
| **E. NO. CEN.** | | | | | | | | | | | | |
| Ohio | 22 | 41 | 41 | 202 | ----- | 95 | 46 | 26 | 216 | 1 | 3 | 9 |
| Indiana | 17 | 24 | 35 | 596 | 363 | 113 | 5 | 10 | 12 | 0 | 1 | 3 |
| Illinois | 23 | 28 | 38 | 128 | 955 | 67 | 18 | 31 | 31 | 0 | 0 | 8 |
| Michigan [2] | 6 | 12 | 10 | 31 | 39 | 12 | 275 | 424 | 424 | 2 | 0 | 4 |
| Wisconsin | 4 | 1 | 1 | 112 | 56 | 70 | 165 | 1,343 | 1,343 | 0 | 0 | 1 |
| **W. NO. CEN.** | | | | | | | | | | | | |
| Minnesota | 3 | 5 | 2 | 2 | 3 | 3 | 366 | 1,236 | 195 | 1 | 0 | 1 |
| Iowa | 3 | 11 | 8 | 86 | 27 | 27 | 174 | 177 | 100 | 0 | 1 | 2 |
| Missouri | 8 | 10 | 12 | 59 | 137 | 308 | 15 | 11 | 16 | 1 | 3 | 3 |
| North Dakota | 0 | 2 | 2 | 20 | 14 | 14 | 3 | 148 | 15 | 0 | 0 | 0 |
| South Dakota | 0 | 2 | 1 | 6 | 3 | ----- | 2 | 322 | 3 | 0 | 0 | 0 |
| Nebraska | 5 | 6 | 6 | ----- | ----- | ----- | 95 | 62 | 16 | 0 | 0 | 1 |
| Kansas | 11 | 13 | 8 | 32 | 9 | 40 | 479 | 26 | 26 | 5 | 0 | 1 |
| **SO. ATL.** | | | | | | | | | | | | |
| Delaware | 1 | 2 | 1 | ----- | ----- | ----- | 1 | 0 | 34 | 0 | 0 | 0 |
| Maryland [2] | 3 | 2 | 11 | 131 | 182 | 113 | 2 | 1,174 | 214 | 3 | 2 | 2 |
| Dist. of Col. | 5 | 3 | 7 | 19 | 18 | 3 | 2 | 10 | 7 | 0 | 1 | 2 |
| Virginia [2] | 19 | 19 | 17 | 2,395 | 1,338 | ----- | 33 | 176 | 188 | 4 | 1 | 8 |
| West Virginia [2] | 6 | 7 | 12 | 954 | 33 | 88 | 6 | 21 | 21 | 0 | 4 | 4 |
| North Carolina | 17 | 29 | 23 | 121 | 71 | 93 | 109 | 866 | 653 | 0 | 0 | 2 |
| South Carolina [2] | 11 | 17 | 4 | 1,041 | 972 | 972 | 6 | 30 | 30 | 1 | 2 | 1 |
| Georgia [2] | 7 | 11 | 11 | 486 | 139 | 481 | 405 | 161 | 0 | 1 | 2 | 2 |
| Florida [2] | 5 | 4 | 5 | 50 | 1 | 18 | 55 | 53 | 48 | 0 | 0 | 0 |
| **E. SO. CEN.** | | | | | | | | | | | | |
| Kentucky | 9 | 13 | 14 | 136 | 478 | 99 | 42 | 106 | 106 | 2 | 8 | 13 |
| Tennessee [2] | 8 | 10 | 10 | 677 | 63 | 245 | 108 | 119 | 67 | 4 | 1 | 6 |
| Alabama [2] | 7 | 14 | 14 | 933 | 160 | 686 | 148 | 284 | 284 | 1 | 6 | 5 |
| Mississippi [2] | 6 | 6 | 5 | ----- | ----- | ----- | ----- | ----- | ----- | 0 | 4 | 2 |
| **W. SO. CEN.** | | | | | | | | | | | | |
| Arkansas | 5 | 10 | 9 | 1,555 | 113 | 113 | 16 | 107 | 22 | 2 | 1 | 2 |
| Louisiana [2] | 6 | 15 | 15 | 342 | 11 | 24 | 3 | 145 | 40 | 2 | 0 | 1 |
| Oklahoma | 11 | 8 | 8 | 655 | 129 | 217 | 3 | 94 | 34 | 0 | 2 | 5 |
| Texas [2] | 41 | 51 | 56 | 4,543 | 983 | 981 | 304 | 228 | 202 | 3 | 6 | 6 |
| **MOUNTAIN** | | | | | | | | | | | | |
| Montana | 3 | 1 | 1 | 4 | 35 | 35 | 38 | 366 | 56 | 0 | 0 | 0 |
| Idaho | 0 | 5 | 1 | ----- | ----- | 6 | 26 | 36 | 29 | 0 | 0 | 0 |
| Wyoming | 1 | 0 | 0 | 5 | ----- | ----- | 34 | 17 | 3 | 0 | 0 | 0 |
| Colorado | 13 | 16 | 10 | 27 | 125 | ----- | 34 | 91 | 91 | 3 | 0 | 0 |
| New Mexico | 1 | 1 | 6 | 4 | 1 | 8 | 5 | 42 | 42 | 0 | 0 | 0 |
| Arizona | 0 | 6 | 1 | 259 | 82 | 151 | 20 | 21 | 21 | 4 | 0 | 0 |
| Utah [2] | 0 | 0 | 0 | 10 | 16 | ----- | 203 | 81 | 11 | 0 | 0 | 0 |
| **PACIFIC** | | | | | | | | | | | | |
| Washington | 2 | 0 | 1 | 3 | 3 | 3 | 664 | 271 | 174 | 1 | 1 | 1 |
| Oregon | 8 | 2 | 2 | 70 | 42 | 71 | 351 | 27 | 27 | 0 | 0 | 0 |
| California | 20 | 32 | 30 | 771 | 28 | 306 | 374 | 2,534 | 530 | 2 | 1 | 8 |
| Total | 397 | 524 | 539 | 16,548 | 6,895 | 8,591 | 5,859 | 13,876 | 13,876 | 67 | 63 | 134 |
| 7 weeks | 3,025 | 4,042 | 4,594 | 98,728 | 27,772 | 27,772 | 31,841 | 75,068 | 75,068 | 265 | 386 | 673 |

See footnotes at end of table.

*Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median*—Continued.

| Division and State | Poliomyelitis | | | Scarlet fever | | | Smallpox | | | Typhoid and paratyphoid fever | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 | Week ended | | Median, 1935–39 |
| | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | | Feb. 17, 1940 | Feb. 18, 1939 | |
| NEW ENGLAND | | | | | | | | | | | | |
| Maine | 0 | 0 | 0 | 26 | 28 | 23 | 0 | 0 | 0 | 0 | 1 | 0 |
| New Hampshire | 0 | 0 | 0 | 4 | 4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vermont | 0 | 0 | 0 | 12 | 12 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| Massachusetts | 0 | 0 | 0 | 146 | 222 | 252 | 0 | 0 | 0 | 1 | 3 | 2 |
| Rhode Island | 0 | 0 | 0 | 11 | 17 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| Connecticut | 0 | 0 | 0 | 92 | 92 | 92 | 0 | 0 | 0 | 1 | 1 | 0 |
| MID. ATL. | | | | | | | | | | | | |
| New York | 1 | 0 | 0 | 750 | 648 | 771 | 0 | 0 | 0 | 4 | 6 | 6 |
| New Jersey | 0 | 1 | 0 | 466 | 166 | 166 | 0 | 0 | 0 | 0 | 0 | 1 |
| Pennsylvania | 2 | 0 | 0 | 370 | 524 | 552 | 0 | 0 | 0 | 5 | 6 | 6 |
| E. NO. CEN. | | | | | | | | | | | | |
| Ohio | 0 | 0 | 1 | 419 | 493 | 473 | 0 | 41 | 1 | 1 | 5 | 2 |
| Indiana | 0 | 2 | 0 | 236 | 231 | 231 | 0 | 80 | 3 | 8 | 5 | 2 |
| Illinois | 1 | 1 | 1 | 524 | 510 | 668 | 0 | 21 | 21 | 3 | 3 | 5 |
| Michigan [2] | 0 | 0 | 1 | 290 | 538 | 538 | 0 | 20 | 3 | 2 | 4 | 2 |
| Wisconsin | 3 | 0 | 0 | 170 | 284 | 320 | 10 | 5 | 5 | 0 | 0 | 1 |
| W. NO. CEN. | | | | | | | | | | | | |
| Minnesota | 1 | 0 | 0 | 109 | 109 | 151 | 7 | 8 | 8 | 1 | 0 | 0 |
| Iowa | 1 | 0 | 0 | 59 | 142 | 142 | 6 | 35 | 29 | 1 | 1 | 1 |
| Missouri | 0 | 0 | 0 | 80 | 146 | 170 | 9 | 6 | 6 | 0 | 0 | 2 |
| North Dakota | 0 | 0 | 0 | 21 | 9 | 59 | 0 | 1 | 1 | 2 | 1 | 1 |
| South Dakota | 0 | 0 | 0 | 30 | 15 | 15 | 3 | 8 | 3 | 0 | 0 | 0 |
| Nebraska | 0 | 0 | 0 | 18 | 90 | 90 | 0 | 6 | 16 | 0 | 0 | 0 |
| Kansas | 0 | 0 | 0 | 88 | 170 | 201 | 0 | 5 | 13 | 1 | 4 | 1 |
| SO. ATL. | | | | | | | | | | | | |
| Delaware | 0 | 0 | 0 | 25 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maryland [2] | 0 | 0 | 0 | 65 | 33 | 56 | 0 | 0 | 0 | 0 | 1 | 1 |
| Dist. of Col. | 0 | 0 | 0 | 24 | 20 | 21 | 0 | 0 | 0 | 1 | 1 | 1 |
| Virginia [2] | 0 | 0 | 0 | 27 | 45 | 43 | 0 | 0 | 0 | 2 | 6 | 6 |
| West Virginia [2] | 1 | 2 | 1 | 78 | 75 | 57 | 0 | 0 | 0 | 2 | 3 | 3 |
| North Carolina | 0 | 1 | 0 | 55 | 77 | 42 | 0 | 0 | 0 | 0 | 5 | 1 |
| South Carolina [2] | 0 | 2 | 0 | 8 | 6 | 4 | 0 | 0 | 0 | 1 | 6 | 1 |
| Georgia [2] | 0 | 1 | 0 | 18 | 19 | 19 | 0 | 1 | 0 | 2 | 4 | 3 |
| Florida [2] | 0 | 0 | 0 | 20 | 11 | 11 | 0 | 1 | 0 | 2 | 1 | 1 |
| E. SO. CEN. | | | | | | | | | | | | |
| Kentucky | 2 | 2 | 2 | 59 | 104 | 54 | 1 | 14 | 0 | 1 | 6 | 6 |
| Tennessee [2] | 2 | 0 | 0 | 103 | 47 | 43 | 0 | 1 | 0 | 0 | 3 | 1 |
| Alabama [2] | 1 | 0 | 0 | 14 | 20 | 19 | 0 | 0 | 0 | 0 | 4 | 3 |
| Mississippi [2] | 0 | 0 | 0 | 6 | 4 | 8 | 3 | 0 | 1 | 1 | 1 | 3 |
| W. SO. CEN. | | | | | | | | | | | | |
| Arkansas | 1 | 0 | 0 | 7 | 6 | 14 | 2 | 5 | 4 | 1 | 4 | 2 |
| Louisiana [2] | 1 | 1 | 1 | 6 | 12 | 12 | 0 | 0 | 0 | 3 | 16 | 16 |
| Oklahoma | 1 | 0 | 0 | 23 | 52 | 35 | 1 | 16 | 3 | 4 | 1 | 3 |
| Texas [2] | 4 | 0 | 0 | 53 | 116 | 108 | 1 | 46 | 19 | 7 | 9 | 10 |
| MOUNTAIN | | | | | | | | | | | | |
| Montana | 0 | 0 | 0 | 24 | 32 | 32 | 0 | 1 | 6 | 1 | 0 | 0 |
| Idaho | 0 | 0 | 1 | 12 | 7 | 22 | 0 | 4 | 4 | 2 | 1 | 1 |
| Wyoming | 0 | 0 | 0 | 9 | 7 | 11 | 1 | 0 | 0 | 0 | 0 | 0 |
| Colorado | 0 | 0 | 0 | 55 | 37 | 37 | 9 | 18 | 8 | 0 | 0 | 0 |
| New Mexico | 0 | 0 | 0 | 21 | 19 | 19 | 0 | 1 | 1 | 2 | 0 | 3 |
| Arizona | 0 | 0 | 0 | 4 | 9 | 24 | 1 | 0 | 0 | 0 | 0 | 0 |
| Utah [2] | 2 | 0 | 0 | 28 | 33 | 77 | 1 | 0 | 0 | 1 | 0 | 0 |
| PACIFIC | | | | | | | | | | | | |
| Washington | 0 | 0 | 1 | 58 | 56 | 56 | 0 | 1 | 17 | 0 | 0 | 0 |
| Oregon | 0 | 0 | 0 | 18 | 55 | 55 | 0 | 3 | 3 | 1 | 0 | 1 |
| California | 3 | 0 | 2 | 162 | 166 | 252 | 0 | 17 | 9 | 3 | 3 | 3 |
| Total | 27 | 13 | 25 | 4,903 | 5,518 | 7,067 | 55 | 365 | 299 | 67 | 115 | 115 |
| 7 weeks | 230 | 115 | 150 | 30,854 | 37,320 | 43,602 | 508 | 2,750 | 2,081 | 543 | 776 | 803 |

See footnotes at end of table.

*Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median*—Continued.

| Division and State | Whooping cough | |
|---|---|---|
| | Week ended | |
| | Feb. 17, 1940 | Feb. 18, 1939 |
| **NEW ENG.** | | |
| Maine | 34 | 39 |
| New Hampshire | 3 | 0 |
| Vermont | 41 | 39 |
| Massachusetts | 119 | 325 |
| Rhode Island | 3 | 63 |
| Connecticut | 45 | 91 |
| **MID. ATL.** | | |
| New York | 418 | 552 |
| New Jersey | 120 | 430 |
| Pennsylvania | 377 | 394 |
| **E. NO. CEN.** | | |
| Ohio | 224 | 202 |
| Indiana | 34 | 33 |
| Illinois | 75 | 274 |
| Michigan [2] | 145 | 238 |
| Wisconsin | 137 | 317 |
| **W. NO. CEN.** | | |
| Minnesota | 20 | 25 |
| Iowa | 12 | 14 |
| Missouri | 9 | 36 |
| North Dakota | 3 | 7 |
| South Dakota | 2 | 5 |
| Nebraska | 5 | 8 |
| Kansas | 43 | 10 |
| **SO. ATL.** | | |
| Delaware | 11 | 1 |
| Maryland [2] | 116 | 33 |
| Dist. of Col. | 18 | 24 |
| Virginia [2] | 47 | 73 |
| West Virginia [2] | 21 | 30 |
| North Carolina | 84 | 251 |
| South Carolina [2] | 15 | 82 |
| Georgia [2] | 27 | 33 |
| Florida [2] | 7 | 21 |
| **E. SO. CEN.** | | |
| Kentucky | 48 | 27 |
| Tennessee [2] | 37 | 51 |
| Alabama [3] | 33 | 25 |
| Mississippi [2] | ---------- | ---------- |
| **W. SO. CEN.** | | |
| Arkansas | 5 | 19 |
| Louisiana [2] | 11 | 14 |
| Oklahoma | 0 | 1 |
| Texas [2] | 136 | 155 |
| **MOUNTAIN** | | |
| Montana | 4 | 4 |
| Idaho | 0 | 1 |
| Wyoming | 8 | 0 |
| Colorado | 12 | 51 |
| New Mexico | 60 | 23 |
| Arizona | 12 | 5 |
| Utah [2] | 79 | 28 |
| **PACIFIC** | | |
| Washington | 26 | 13 |
| Oregon | 26 | 5 |
| California | 153 | 77 |
| Total | 2,865 | 4,149 |
| 7 weeks | 19,585 | 30,160 |

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 17, 1940, 18 cases as follows: Virginia, 1; South Carolina, 2; Georgia, 2; Florida, 3; Tennessee, 1; Alabama, 3; Louisiana, 1; Texas, 5.

# WEEKLY REPORTS FROM CITIES

## *City reports for week ended February 3, 1940*

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 | 188 | 1,332 | 151 | 4,030 | 969 | 1,965 | 39 | 383 | 18 | 1,161 | ------ |
| Current week [1] | 124 | 969 | 111 | 1,157 | 708 | 1,429 | 3 | 364 | 21 | 734 | ------ |
| Maine: | | | | | | | | | | | |
| Portland | 0 | ------ | 0 | 21 | 0 | 2 | 0 | 0 | 0 | 9 | 28 |
| New Hampshire: | | | | | | | | | | | |
| Concord | 0 | ------ | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 8 |
| Manchester | 0 | ------ | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| Nashua | 0 | ------ | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| Vermont: | | | | | | | | | | | |
| Barre | 0 | ------ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| Burlington | 0 | ------ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 10 |
| Rutland | 0 | ------ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Massachusetts: | | | | | | | | | | | |
| Boston | 0 | ------ | 0 | 19 | 20 | 25 | 0 | 7 | 0 | 33 | 237 |
| Fall River | 0 | ------ | 0 | 11 | 1 | 0 | 0 | 0 | 0 | 1 | 28 |
| Springfield | 0 | ------ | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 34 |
| Worchester | 1 | ------ | 0 | 2 | 12 | 2 | 0 | 2 | 0 | 3 | 63 |
| Rhode Island: | | | | | | | | | | | |
| Pawtucket | 0 | ------ | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 11 |
| Providence | 0 | 1 | 1 | 116 | 5 | 10 | 0 | 4 | 0 | 11 | 70 |
| Connecticut: | | | | | | | | | | | |
| Bridgeport | 0 | 3 | 1 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 36 |
| Hartford | 0 | ------ | 0 | 1 | 3 | 2 | 0 | 3 | 9 | 8 | 50 |
| New Haven | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 3 | 37 |
| New York: | | | | | | | | | | | |
| Buffalo | 0 | ------ | 1 | 0 | 18 | 15 | 0 | 8 | 0 | 3 | 172 |
| New York | 26 | 19 | 2 | 41 | 65 | 331 | 0 | 75 | 0 | 87 | 1,568 |
| Rochester | 0 | 2 | 0 | 1 | 4 | 14 | 0 | 1 | 0 | 9 | 76 |
| Syracuse | 0 | ------ | 0 | 0 | 4 | 5 | 0 | 1 | 0 | 8 | 52 |
| New Jersey: | | | | | | | | | | | |
| Camden | 0 | ------ | 2 | 0 | 8 | 8 | 0 | 0 | 0 | 1 | 30 |
| Newark | 0 | ------ | 0 | 7 | 5 | 20 | 0 | 8 | 0 | 13 | 126 |
| Trenton | 0 | 1 | 0 | 2 | 2 | 3 | 0 | 7 | 0 | 0 | 48 |
| Pennsylvania: | | | | | | | | | | | |
| Philadelphia | 4 | 47 | 15 | 10 | 43 | 71 | 0 | 25 | 0 | 48 | 639 |
| Pittsburgh | 2 | 18 | 6 | 0 | 29 | 34 | 0 | 5 | 0 | 6 | 216 |
| Reading | 0 | ------ | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 10 | 29 |
| Scranton | 0 | ------ | -------- | 1 | ------- | 7 | 0 | ------- | 0 | 0 | -------- |
| Ohio: | | | | | | | | | | | |
| Cincinnati | 1 | 1 | 0 | 0 | 9 | 13 | 0 | 4 | 0 | 24 | 157 |
| Cleveland | 2 | 51 | 0 | 4 | 14 | 30 | 0 | 13 | 0 | 30 | 187 |
| Columbus | 1 | 2 | 2 | 0 | 6 | 5 | 0 | 2 | 0 | 2 | 113 |
| Toledo | 0 | 2 | 0 | 1 | 2 | 12 | 0 | 5 | 0 | 9 | 84 |
| Indiana: | | | | | | | | | | | |
| Anderson | 0 | ------ | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 14 |
| Fort Wayne | 1 | ------ | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 26 |
| Indianapolis | 5 | ------ | 0 | 0 | 17 | 26 | 0 | 3 | 0 | 3 | 110 |
| Muncie | 1 | ------ | 1 | 0 | 5 | 4 | 2 | 1 | 0 | 0 | 21 |
| South Bend | 0 | ------ | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 11 |
| Terre Haute | 0 | ------ | 0 | 0 | 6 | 2 | 0 | 1 | 0 | 1 | 20 |
| Illinois: | | | | | | | | | | | |
| Chicago | 7 | 88 | 5 | 23 | 45 | 344 | 0 | 30 | 0 | 41 | 810 |
| Elgin | 0 | ------ | 0 | 1 | 1 | 7 | 0 | 0 | 0 | 0 | 18 |
| Moline | 0 | ------ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Springfield | 0 | 3 | 2 | 0 | 6 | 13 | 0 | 1 | 2 | 3 | 37 |
| Michigan: | | | | | | | | | | | |
| Detroit | 11 | ------ | 0 | 8 | 21 | 68 | 0 | 12 | 0 | 25 | 328 |
| Flint | 0 | ------ | 0 | 0 | 5 | 7 | 0 | 0 | 0 | 5 | 32 |
| Grand Rapids | 0 | 1 | 1 | 1 | 2 | 12 | 0 | 0 | 0 | 4 | 44 |
| Wisconsin: | | | | | | | | | | | |
| Kenosha | 0 | ------ | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 12 |
| Madison | 0 | ------ | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 4 | 17 |
| Milwaukee | 0 | 1 | 1 | 1 | 5 | 42 | 0 | 3 | 0 | 3 | 107 |
| Racine | 0 | ------ | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 7 | 21 |
| Superior | 0 | ------ | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 15 |

[1] Figures for Little Rock and Boise estimated; reports not received.

*City reports for week ended February 3, 1940*—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 | | | | | | | | |
| **Minnesota:** | | | | | | | | | | | |
| Duluth | 0 | ---- | 0 | 284 | 3 | 2 | 0 | 1 | 0 | 2 | 33 |
| Minneapolis | 0 | ---- | 1 | 5 | 3 | 23 | 0 | 4 | 0 | 6 | 104 |
| St. Paul | 0 | 1 | 1 | 1 | 4 | 11 | 0 | 0 | 0 | 21 | 71 |
| **Iowa:** | | | | | | | | | | | |
| Davenport | 0 | ---- | ---- | 0 | ---- | 0 | 0 | ---- | 0 | 0 | ---- |
| Des Moines | 1 | ---- | 0 | 2 | 0 | 9 | 0 | 0 | 0 | 0 | 31 |
| Sioux City | 0 | ---- | ---- | 0 | ---- | 3 | 0 | ---- | 0 | 0 | ---- |
| Waterloo | 1 | ---- | ---- | 0 | ---- | 2 | 0 | ---- | 0 | 0 | ---- |
| **Missouri:** | | | | | | | | | | | |
| Kansas City | 2 | 3 | 0 | 0 | 6 | 24 | 0 | 5 | 0 | 8 | 115 |
| St. Joseph | 0 | ---- | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 24 |
| St. Louis | 4 | 4 | 2 | 2 | 18 | 22 | 2 | 8 | 2 | 1 | 267 |
| **North Dakota:** | | | | | | | | | | | |
| Fargo | 0 | ---- | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| Grand Forks | 0 | ---- | ---- | 0 | ---- | 1 | 0 | ---- | 0 | 1 | ---- |
| Minot | 0 | ---- | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| **South Dakota:** | | | | | | | | | | | |
| Aberdeen | 0 | ---- | ---- | 0 | ---- | 0 | 0 | ---- | 0 | 1 | ---- |
| **Nebraska:** | | | | | | | | | | | |
| Lincoln | 0 | ---- | ---- | 0 | ---- | 3 | 0 | ---- | 0 | 0 | ---- |
| Omaha | 0 | ---- | 0 | 2 | 4 | 2 | 0 | 0 | 0 | 3 | 58 |
| **Kansas:** | | | | | | | | | | | |
| Lawrence | 1 | 12 | ---- | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| Topeka | 0 | 1 | 1 | 1 | 4 | 8 | 0 | 0 | 0 | 0 | 22 |
| Wichita | 0 | 1 | 0 | 230 | 3 | 3 | 0 | 0 | 0 | 2 | 31 |
| **Delaware:** | | | | | | | | | | | |
| Wilmington | 0 | ---- | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 26 |
| **Maryland:** | | | | | | | | | | | |
| Baltimore | 4 | 56 | 4 | 3 | 27 | 20 | 0 | 12 | 0 | 107 | 289 |
| Cumberland | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 14 |
| Frederick | 0 | ---- | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| **Dist. of Col:** | | | | | | | | | | | |
| Washington | 8 | 24 | 5 | 0 | 45 | 23 | 0 | 13 | 0 | 9 | 276 |
| **Virginia:** | | | | | | | | | | | |
| Lynchburg | 0 | ---- | 0 | 0 | 5 | 3 | 0 | 1 | 0 | 7 | 19 |
| Richmond | 0 | ---- | 1 | 0 | 0 | 7 | 0 | 1 | 1 | 0 | 81 |
| Roanoke | 0 | ---- | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 2 | 25 |
| **West Virginia:** | | | | | | | | | | | |
| Charleston | 1 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| Huntington | 0 | ---- | ---- | 0 | ---- | 1 | 0 | ---- | 0 | 0 | ---- |
| Wheeling | 0 | ---- | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 16 |
| **North Carolina:** | | | | | | | | | | | |
| Gastonia | 1 | ---- | ---- | 0 | ---- | 1 | 0 | ---- | 0 | 2 | ---- |
| Raleigh | 0 | ---- | 0 | 0 | 7 | 0 | 0 | 1 | 0 | 0 | 32 |
| Wilmington | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| Winston-Salem | 1 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 19 |
| **South Carolina:** | | | | | | | | | | | |
| Charleston | 0 | 157 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 39 |
| Florence | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 13 |
| Greenville | 0 | ---- | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 14 |
| **Georgia:** | | | | | | | | | | | |
| Atlanta | 0 | 115 | 8 | 34 | 17 | 3 | 0 | 6 | 0 | 0 | 125 |
| Brunswick | 0 | ---- | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| Savannah | 0 | 50 | 4 | 0 | 4 | 4 | 0 | 1 | 0 | 0 | 43 |
| **Florida:** | | | | | | | | | | | |
| Miami | 0 | 8 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 3 | 60 |
| Tampa | 2 | 18 | 2 | 11 | 6 | 1 | 0 | 0 | 0 | 2 | 53 |
| **Kentucky:** | | | | | | | | | | | |
| Ashland | 1 | 7 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 6 | 6 |
| Covington | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 18 |
| Lexington | 0 | ---- | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 3 | 25 |
| Louisville | 0 | 34 | 1 | 1 | 13 | 15 | 0 | 1 | 0 | 31 | 85 |
| **Tennessee:** | | | | | | | | | | | |
| Knoxville | 0 | 5 | 3 | 0 | 5 | 13 | 0 | 1 | 0 | 0 | 50 |
| Memphis | 0 | 27 | 4 | 2 | 8 | 22 | 0 | 6 | 0 | 3 | 114 |
| Nashville | 0 | ---- | 6 | 20 | 12 | 3 | 0 | 6 | 0 | 2 | 80 |
| **Alabama:** | | | | | | | | | | | |
| Birmingham | 0 | 33 | 2 | 0 | 9 | 3 | 0 | 4 | 0 | 0 | 115 |
| Mobile | 1 | ---- | 4 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 37 |
| Montgomery | 1 | 9 | ---- | 6 | ---- | 0 | 0 | ---- | 0 | 0 | ---- |
| **Arkansas:** | | | | | | | | | | | |
| Fort Smith | 0 | 27 | ---- | 0 | ---- | 0 | 0 | ---- | 0 | 0 | ---- |
| Little Rock | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| **Louisiana:** | | | | | | | | | | | |
| Lake Charles | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| New Orleans | 2 | 57 | 5 | 0 | 27 | 4 | 0 | 12 | 2 | 19 | 257 |
| Shreveport | 1 | ---- | 1 | 0 | 11 | 0 | 0 | 3 | 2 | 0 | 59 |

*City reports for week ended February 3, 1940*—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 | | | | | | | | |
| Oklahoma: | | | | | | | | | | | |
| Oklahoma City | 0 | ------ | 0 | 0 | 5 | 2 | 0 | 1 | 0 | 0 | 62 |
| Tulsa | 3 | ------ | ------ | 0 | ------ | 10 | 0 | ------ | 0 | 2 | ------ |
| Texas: | | | | | | | | | | | |
| Dallas | 21 | 12 | 2 | 9 | 8 | 18 | 0 | 4 | 0 | 20 | 77 |
| Fort Worth | 0 | ------ | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 14 | 48 |
| Galveston | 1 | ------ | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 22 |
| Houston | 3 | 5 | 1 | 0 | 19 | 4 | 0 | 6 | 0 | 1 | 115 |
| San Antonio | 2 | 5 | 5 | 35 | 18 | 0 | 0 | 8 | 1 | 0 | 115 |
| Montana: | | | | | | | | | | | |
| Billings | 0 | ------ | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 9 |
| Great Falls | 0 | ------ | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 6 |
| Helena | 0 | ------ | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Missoula | 0 | ------ | 0 | 24 | 1 | 1 | 0 | 0 | 0 | 0 | 6 |
| Idaho: | | | | | | | | | | | |
| Boise | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| Colorado: | | | | | | | | | | | |
| Denver | 2 | ------ | 2 | 5 | 7 | 7 | 0 | 2 | 0 | 6 | 86 |
| Pueblo | 1 | ------ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 7 |
| New Mexico: | | | | | | | | | | | |
| Albuquerque | 0 | ------ | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 2 | 13 |
| Utah: | | | | | | | | | | | |
| Salt Lake City | 1 | ------ | 1 | 15 | 1 | 13 | 1 | 1 | 1 | 85 | 37 |
| Washington: | | | | | | | | | | | |
| Seattle | 0 | ------ | 2 | 119 | 12 | 7 | 0 | 6 | 0 | 0 | 109 |
| Spokane | 0 | ------ | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 5 | 33 |
| Tacoma | 0 | ------ | 0 | 64 | 5 | 3 | 0 | 1 | 0 | 0 | 39 |
| Oregon: | | | | | | | | | | | |
| Portland | 2 | 26 | 2 | 49 | 11 | 6 | 0 | 1 | 0 | 9 | 104 |
| Salem | 0 | ------ | ------ | 17 | ------ | 0 | 0 | ------ | 0 | 0 | ------ |
| California: | | | | | | | | | | | |
| Los Angeles | 3 | 194 | 2 | 10 | 5 | 36 | 0 | 17 | 0 | 9 | 374 |
| Sacramento | 0 | 3 | 2 | 1 | 3 | 0 | 0 | 3 | 0 | 0 | 39 |
| San Francisco | 1 | 3 | 0 | 0 | 8 | 10 | 0 | 6 | 0 | 10 | 191 |

| State and city | Meningococcus meningitis | | Poliomyelitis cases | State and city | Meningococcus meningitis | | Poliomyelitis cases |
|---|---|---|---|---|---|---|---|
| | Cases | Deaths | | | Cases | Deaths | |
| Rhode Island: | | | | Maryland: | | | |
| Providence | 0 | 0 | 1 | Baltimore | 2 | 0 | 0 |
| New York: | | | | Washington: | | | |
| New York | 3 | 0 | 0 | Seattle | 10 | 0 | 0 |
| Michigan: | | | | Spokane | 0 | 1 | 0 |
| Detroit | 0 | 0 | 1 | California: | | | |
| Minnesota: | | | | Los Angeles | 0 | 0 | 1 |
| Minneapolis | 0 | 0 | 1 | San Francisco | 1 | 0 | 0 |

*Encephalitis, epidemic or lethargic.*—Cases: New York, 1.
*Pellagra.*—Cases: Boston, 1; Philadelphia, 1; Savannah, 2; New Orleans, 1; Dallas, 1.
*Typhus fever.*—Cases: New York, 1.

# FOREIGN REPORTS

## GREAT BRITAIN

*England and Wales—Infectious diseases—13 weeks ended September 30, 1939.*—During the 13 weeks ended September 30, 1939, cases of certain infectious diseases were reported in England and Wales as follows:

| Disease | Cases | Disease | Cases |
|---|---|---|---|
| Diphtheria | 10,524 | Puerperal pyrexia | 2,347 |
| Dysentery | 462 | Scarlet fever | 18,360 |
| Ophthalmia neonatorum | 1,140 | Typhoid fever | 631 |
| Pneumonia | 4,681 | | |

*England and Wales—Vital statistics—Third quarter 1939.*—During the third quarter ended September 30, 1939, 161,201 live births and 103,170 deaths were registered in England and Wales. The following statistics were taken from the Quarterly Return of Births, Deaths, and Marriages, issued by the Registrar General, and are provisional:

*Birth and death rates in England and Wales, quarter ended September 30, 1939*

| | |
|---|---|
| Annual rates per 1,000 population: | |
| Live births | 15.5 |
| Stillbirths | .57 |
| Deaths, all causes | 9.9 |
| Deaths under 1 year of age | [1] 39 |
| Deaths from: | |
| Diarrhea and enteritis (under 2 years of age) | [1] 4.6 |
| Annual rates per 1,000 population—Continued: | |
| Deaths from—Continued: | |
| Diphtheria | .04 |
| Influenza | .03 |
| Measles | .01 |
| Whooping cough | .02 |

[1] Per 1,000 live births.

# WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following table must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

## CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

| Place | | Jan. 1–Nov. 30, 1939 | December 1939 | January 1940—week ended— | | | |
|---|---|---|---|---|---|---|---|
| | | | | 6 | 13 | 20 | 27 |
| **ASIA** | | | | | | | |
| Afghanistan | D | 578 | | | | | |
| Ceylon: Batticaloa | C | 7 | | | | | |
| China | C | 2,705 | | | | | |
| Canton | C | 9 | | | | | |
| Hong Kong | C | 684 | 4 | | | | |
| Shanghai | C | 427 | | | | | |
| Tientsin | C | 34 | | | | | |
| India | C | 114,943 | | | | | |
| Bassein | C | 14 | | | | | |
| Calcutta | C | 3,803 | 124 | 32 | 14 | 31 | 22 |
| Madras | C | 6 | | | | | 1 |
| Negapatam | C | 2 | | | | | |
| Rangoon | C | 17 | 1 | | 1 | 1 | 4 |
| India (French) | C | 91 | | | | | |
| India (Portuguese) | C | 17 | | | | | |
| Indochina (French) | C | 1 | | | | | |
| Iran | C | 435 | | | | | |
| Iraq: Basra | C | [1] 1 | | | | | |
| Japan: Osaka | C | [2] 1 | | | | | |
| Thailand | C | 25 | | | | | |
| Bangkok | C | 7 | | | | | |

## PLAGUE

[C indicates cases, D, deaths]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AFRICA** | | | | | | | |
| Algeria: Algiers | C | 1 | | | | | |
| Belgian Congo | C | 54 | 4 | | | | |
| British East Africa: | | | | | | | |
| Kenya | C | 4 | | | | | |
| Nyasaland | C | 2 | | | | | |
| Uganda | C | 299 | 11 | | | | |
| Egypt: Asyut Province | C | 102 | | 1 | | 7 | 18 |
| Madagascar | C | 476 | | | | | |
| Tunisia: Tunis | C | 1 | | | | | |
| Plague-infected rats | | 5 | | | | | |
| Union of South Africa | C | 74 | 6 | | | | |
| **ASIA** | | | | | | | |
| China: | | | | | | | |
| Fukien Province | D | [3] 753 | | | | | |
| Manchuria | D | 332 | | | | | |
| Dutch East Indies: | | | | | | | |
| Java: | | | | | | | |
| Batavia | C | [2] 1 | | | | | |
| Batavia Residency | D | [4] 84 | | | | | |
| Java and Madura | C | 1,491 | | | | | |
| India | C | 54,845 | | | | | |
| Bassein | C | 12 | | | | | |
| Calcutta | C | [2] 1 | [2] 1 | | | | |
| Cochin | C | 1 | 2 | | | | |
| Plague-infected rats | | 1 | 8 | | | 2 | 1 |
| Rangoon | C | [1] 8 | | | | | [2] 1 |
| Indochina (French) | C | 2 | | | | | |
| Thailand: | | | | | | | |
| Bichitr Province | C | 4 | | | | | |
| Bisnulok Province | C | 85 | | | | | |
| Kamphaeng Bajr Province | C | | 16 | 2 | 28 | | |
| Lampang Province | C | 1 | | | | | |
| Prae Province | C | 6 | | | | | |
| Svargalok Province | C | 30 | | | | | |
| Tak Province | C | 10 | | | | | |

[1] Suspected.
[2] Imported.
[3] Includes 94 deaths from pneumonic plague.
[4] Pneumonic.
[5] Includes 1 imported case.

# WORLD DISTRIBUTION OF CHOLERA PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## PLAGUE—Continued

| Place | | Jan. 1–Nov. 30, 1939 | December 1939 | January 1940—week ended— 6 | 13 | 20 | 27 |
|---|---|---|---|---|---|---|---|
| **NORTH AMERICA** | | | | | | | |
| United States. (See issue of Feb. 9, p. 258.) | | | | | | | |
| **SOUTH AMERICA** | | | | | | | |
| Argentina: | | | | | | | |
| Jujuy Province | C | 1 | | | | | |
| Mendoza Province | C | 1 | | | | | |
| Salta Province | C | 1 | | | | | |
| San Luis Province | C | 1 | | | | | |
| Tucuman Province | C | 1 | | | | | |
| Bolivia | C | [4] 2 | [6] 30 | | | | |
| Brazil: | | | | | | | |
| Alagoas State | C | 43 | | | | | |
| Bahia State | C | 1 | | | | | |
| Parahiba State | C | 1 | | | | | |
| Pernambuco State | C | 32 | | | | | |
| Sao Paulo State | C | 1 | | | | | |
| Ecuador: | | | | | | | |
| Chimborazo Province | C | 24 | | | | | |
| Riobamba | C | [4] 16 | | | | | |
| Guayaquil | C | 3 | | | | | |
| Plague-infected rats | | 45 | | | | | |
| Loja | C | 4 | | | | | |
| Puebla Viejo | C | 3 | | | | | |
| Peru: | | | | | | | |
| Cajamarca Department | C | 9 | | | | | |
| Lambayeque Department | C | 8 | | | | | |
| Libertad Department | C | 26 | | | | | |
| Lima Department | C | 27 | | | | | |
| Piura Department | C | 30 | | | | | |
| Venezuela [7] | C | | 3 | | | | |
| **OCEANIA** | | | | | | | |
| Hawaii Territory: | | | | | | | |
| Paauhau | C | | [8] 1 | | | | |
| Plague-infected rats | | 47 | 7 | 1 | | | 1 |

## SMALLPOX

[C indicates cases; D, deaths]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AFRICA** | | | | | | | |
| Algeria | C | 6 | | | | | |
| Angola | C | 104 | | | | | |
| Belgian Congo | C | 1,503 | 148 | | | | |
| British East Africa | C | 680 | 2 | | | | |
| Dahomey | C | 51 | | | | | |
| Eritrea | C | 2 | | | | | |
| French Equatorial Africa | C | 45 | | | | | |
| French Guinea | C | 40 | | | | | |
| Gold Coast | C | 141 | | | | | |
| Ivory Coast | C | 308 | 19 | | | | |
| Morocco | C | 10 | | | | | |
| Mozambique | C | 86 | | | | | |
| Nigeria | C | 4,448 | 52 | | | | |
| Niger Territory | C | 134 | | | | | |
| Portuguese East Africa | C | 24 | | | | | |
| Portuguese Guinea | C | 122 | | | | | |
| Rhodesia: | | | | | | | |
| Northern | C | 20 | | | | | |
| Southern | C | 140 | | | | | |
| Senegal | C | 256 | 1 | | | | |
| Sierra Leone | C | 50 | | | | | |
| Sudan (Anglo-Egyptian) | C | 416 | 136 | | 22 | | 53 |
| Sudan (French) | C | 27 | | | | | |
| Union of South Africa | C | 209 | | | | | |

[4] Pneumonic.
[6] Oct. 1–Dec. 31, 1939.
[7] For the period Dec. 7, 1939, to Jan. 4, 1940, 11 cases of plague with 8 deaths were reported from the interior of Venezuela.
[8] Pneumonic plague; proved fatal.

# WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## SMALLPOX—Continued

| Place | | Jan. 1–Nov. 30, 1939 | December 1939 | January 1940—week ended— | | | |
|---|---|---|---|---|---|---|---|
| | | | | 6 | 13 | 20 | 27 |
| **ASIA** | | | | | | | |
| Arabia | C | 1 | | | | | |
| Ceylon | C | 1 | | | | | |
| China | C | 1,569 | 24 | 13 | 24 | | |
| Chosen | C | 155 | | | | | |
| India | C | 101,647 | | | | | |
| India (French) | C | 59 | | | | | |
| Indochina (French) | C | 3,558 | 36 | | | | |
| Iran | C | 66 | 19 | | | | |
| Iraq | C | 51 | 40 | 5 | 6 | | |
| Japan | C | 228 | 1 | | | | |
| Straits Settlements | C | 1 | | | | | |
| Syria | C | 1 | | | | | |
| Thailand | C | 155 | | | | | |
| **EUROPE** | | | | | | | |
| France | C | 4 | | | | | |
| Great Britain | C | 1 | | | | 1 | |
| Greece | C | 69 | | | | | |
| Portugal | C | 922 | 28 | 11 | | | |
| Spain | C | 454 | 256 | 9 | | | |
| Canary Islands | C | 3 | | | | | |
| Turkey | C | 388 | | | | | |
| **NORTH AMERICA** | | | | | | | |
| Canada | C | 156 | 4 | | | | |
| Guatemala | C | 9 | | | | | |
| Mexico | D | 1,264 | | | | | |
| Salvador | C | 1 | | | | | |
| **SOUTH AMERICA** | | | | | | | |
| Argentina | C | 3 | | | | | |
| Bolivia | C | 187 | [1] 60 | | | | |
| Brazil | C | 13 | | | | | |
| Colombia | C | 2,740 | 8 | 9 | | | |
| Ecuador | C | 8 | | | | | |
| Uruguay | C | 5 | | | | | |
| Venezuela | C | 100 | 9 | | | | |

## TYPHUS FEVER

[C indicates cases; D, deaths]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AFRICA** | | | | | | | |
| Algeria | C | 1,826 | 46 | | | | |
| Belgian Congo | C | | | 27 | | | |
| British East Africa | C | 2 | | | | | |
| Egypt | C | 4,017 | 101 | 31 | 29 | | 68 |
| Eritrea | C | 9 | | | | | |
| Libya | C | 37 | | | | | |
| Morocco | C | 897 | 4 | | | | |
| Nigeria | C | 2 | | | | | |
| Portuguese East Africa | C | 2 | | | | | |
| Southern Rhodesia | C | 3 | | | | | |
| Swaziland | C | 1 | | | | | |
| Tunisia | C | 6,021 | 83 | | | | |
| Union of South Africa | C | 868 | | | | | |
| **ASIA** | | | | | | | |
| China | C | 293 | 15 | | | | |
| Chosen | C | 734 | | | | | |
| India | C | 17 | | 1 | | | |
| Iran | C | 68 | 1 | | | | |
| Iraq | C | 47 | 2 | | | | |
| Palestine | C | 164 | 34 | 2 | 1 | 3 | 1 |
| Straits Settlements | C | 14 | 1 | | | | |
| Sumatra | C | 1 | | | | | |
| Syria | C | 5 | | | | | |
| Trans-Jordan | C | 19 | | 1 | | | |

[1] Oct. 1–Dec. 31, 1939.

# WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## TYPHUS FEVER—Continued

| Place | | Jan. 1–Nov. 30, 1939 | December 1939 | January 1940—week ended— 6 | 13 | 20 | 27 |
|---|---|---|---|---|---|---|---|
| **EUROPE** | | | | | | | |
| Bulgaria | C | 56 | | | | | |
| France | C | | | | 1 | | |
| Greece | C | 13 | | | | | |
| Hungary | C | 23 | | | | 12 | |
| Irish Free State | C | 5 | | | | | |
| Latvia | C | 3 | | | | | |
| Lithuania | C | 153 | | | | | |
| Poland | C | 3,140 | | | | | |
| Portugal | C | 18 | | | | | |
| Rumania | C | 816 | 126 | 39 | 60 | | |
| Spain | C | 54 | 5 | | | | |
| Turkey | C | 395 | | | | | |
| Yugoslavia | C | 379 | 25 | | | | |
| **NORTH AMERICA** | | | | | | | |
| Cuba | C | | [1] 1 | | | | |
| Guatemala | C | 190 | 52 | | | | |
| Mexico | D | 341 | 1 | | | | 1 |
| Panama Canal Zone | C | 3 | | | | | |
| **SOUTH AMERICA** | | | | | | | |
| Bolivia | C | 93 | [2] 69 | | | | |
| Chile | C | 1,144 | | | | | |
| Peru | C | 197 | | | | | |
| Venezuela | C | 10 | | | | | |
| **OCEANIA** | | | | | | | |
| Australia | C | 23 | 1 | | | | |
| Hawaii Territory | C | 30 | 6 | 1 | | | |

## YELLOW FEVER

[C indicates cases; D, deaths]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AFRICA** | | | | | | | |
| Cameroon: | | | | | | | |
| Bafia | C | 1 | | | | | |
| Nkongsamba | C | | | | | | [1] 1 |
| French Equatorial Africa: | | | | | | | |
| Bangui | C | [1] 1 | | | | | |
| Chad—Fort Lamy | C | 1 | | | | | |
| Fort Archambault | C | | | | [4] 2 | | [1] 1 |
| Gabon | D | 1 | | | | | |
| French Guinea | C | 2 | | | | | |
| Gold Coast | C | 2 | | | | | |
| Ivory Coast | C | [5] 23 | [4] 2 | 1 | | | |
| Nigeria | C | [6] 10 | 1 | | | | |
| Niger Territory: | | | | | | | |
| Dosso | C | 3 | | | | | |
| Konni Circle | C | 3 | | | | | |
| Tahua | C | [3] 1 | | | | | |
| Senegal: | | | | | | | |
| Bambey | C | 1 | | | | | |
| Dakar | C | [3] 1 | | | | | |
| Diourbel | C | 6 | | | | | |
| Louga | C | | [3] 1 | | | | |
| Ziguinchor | C | 10 | | | | | |
| Sudan (French): Bandiagara | C | 1 | | | | | |
| Togo (French): Anecho | C | 1 | | | | | |
| **SOUTH AMERICA** | | | | | | | |
| Brazil: | | | | | | | |
| Amazonas State | D | [7] 1 | | | | | |
| Bahia State | D | [7] 1 | | | | | |
| Espirito Santo State | D | 96 | [7] 8 | | | | |
| Minas Geraes State | D | 13 | | | | | |
| Para State | D | 3 | | | | | |
| Rio de Janeiro State | D | 3 | | | | | |
| Colombia: Antioquia Department— | | | | | | | |
| Caracoli | D | 2 | 1 | | | | |
| Jordan | D | | 1 | | | | |
| San Carlos | D | 5 | 1 | | | | |

[1] Exact date not given.
[2] Oct. 1–Dec. 31, 1939.
[3] Suspected.
[4] Includes 1 suspected case.
[5] Includes 7 suspected cases.
[6] Includes 3 suspected cases.
[7] Jungle type.

×