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CURRENT PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES [1]

December 31, 1933–January 27, 1934

The prevalence of certain important communicable diseases, as indicated by weekly telegraphic reports from State health departments to the United States Public Health Service, is summarized in this report. The underlying statistical data are published weekly in the Public Health Reports, under the section entitled "Prevalence of Disease."

Influenza.—The number of cases of influenza reported for the current period was 8,999, approximately 4,000 more than was reported for the preceding four weeks. Compared with recent years the number of cases was about 2,000 in excess of that for the corresponding period in 1932 and 2,000 below that of 1930, in both of which years the incidence of influenza maintained a very satisfactory level during this period. In 1931 this period included a part of a minor influenza epidemic, and 24,685 cases were reported. During this period in 1929 the 1928–29 epidemic reached its maximum with 424,628 cases. The 1932–33 outbreak reached its peak during the month of December 1932; and although the number of cases had dropped about 35,000, the incidence was still very high (122,413 cases) in the month of January 1933.

A comparison of geographic areas shows that the disease has been most prevalent during the current winter in the South Atlantic and South Central areas, but no section of the country has reported more than the normal seasonal prevalence.

Scarlet fever.—The incidence of scarlet fever (21,359 cases) was approximately the same as that for the corresponding period in the last four years. The New England and Middle Atlantic States reported a

[1] From the Office of Statistical Investigations, U.S. Public Health Service. The numbers of States included for the various diseases are as follows: Typhoid fever, 48; poliomyelitis, 48; meningococcus meningitis, 48; smallpox, 48; measles, 47; diphtheria, 48; scarlet fever, 48; influenza, 43 States and New York City. The District of Columbia is counted as a State in these reports. These summaries include only the 8 important communicable diseases for which the Public Health Service receives regular weekly reports from the State health officers.

25 percent decrease from last year's figure, while in the North Central areas the incidence was approximately the same as that for last year. The South Atlantic, South Central, and the Mountain and Pacific areas reported the highest incidence of the disease for this period in recent years. In each of those areas the current incidence was approximately 1.5 times that for the corresponding period last year.

Meningococcus meningitis.—Although the number of cases of meningococcus meningitis increased slightly, as is usual at this season of the year, the disease was still considerably less prevalent than during the same period in recent years. For the current 4-week period the number of cases was 210, which was only about 60 percent of the number reported for the corresponding period in 1933 and 1932—both rather normal years. For this period in 1931 and 1930 the numbers of cases were 595 and 942, respectively. All sections of the country share in the favorable situation which now exists.

Measles.—There were 51,498 cases of measles reported for the 4 weeks ended January 27, an increase of approximately 30,000 over the preceding 4-week period. All regions contributed to the increase. For the country as a whole the incidence was 2.4 times that for the corresponding period last year; in fact, it was the highest incidence of the disease in this period in the 6 years for which comparable data are available.

The same situation as described for the country as a whole existed in all geographic areas except the East North Central. In that area the number of cases (3,281) was only 65 percent of last year's figure, approximately the same as in 1932, but also considerably below that of the 3 preceding years. The disease was most prevalent in the South Atlantic, South Central, Mountain, and Pacific areas. In the South Atlantic and the Mountain and Pacific areas the number of cases reported for the current period was 4.5 times that for last year, while in the South Central the number of current cases was approximately 10 times that for last year.

Smallpox.—The incidence of smallpox continued to decline. For the current 4-week period 498 cases were reported—the lowest number for this period in the 6 years for which data are available. Each geographic area shared in this favorable situation except the East North Central. In that area the number of cases reported (154) was 1.6 times that for this period last year. It was, however, like all other areas, considerably below the incidence in the 5 preceding years. An unusually high incidence of smallpox in Wisconsin during the past few months is responsible for the excess over last year in the East North Central section. For the current period, 127 of the 154 cases reported from that area occurred in Wisconsin. For this period last year Wisconsin reported 16 cases.

Typhoid fever.—For the country as a whole the number of cases (658) of typhoid fever reported for the 4 weeks ended January 27 was about 90 percent of that for the corresponding period last year, 70 percent of the number in 1932, and approximately the same as that in 1931 and 1930. In the South Central and the Mountain and Pacific areas the current incidence was approximately 1.5 times that for the same period last year, and in the New England and Middle Atlantic and the South Atlantic sections it was 1.2 times last year's incidence. The East North Central area reported a slight increase, and in the West North Central group the number of cases (43) was only about 15 percent of last year's figure. At this time last year North Dakota reported an outbreak of typhoid fever. Out of the 270 cases reported for this period from the entire West North Central group, North Dakota had 251. For the current period three cases were reported from that State.

Diphtheria.—The diphtheria incidence was approximately the same as that for the corresponding period last year. For the 4 weeks ended January 27 the number of cases was 4,259. While the incidence for the past few months has been practically on a level with last year, it is still considerably below that of preceding years. For this period in the years 1932, 1931, and 1930, the numbers of cases were 6,730, 5,429, and 6,706, respectively. Each geographic area, except the New England and Middle Atlantic and the East North Central, reported slight increases over the corresponding period last year. Those areas each reported a 25-percent decrease.

Poliomyelitis.—The number of cases of poliomyelitis reported for the 4 weeks ended January 27 was 97, as compared with 82, 156, and 194 for the corresponding period in the years 1933, 1932, and 1931, respectively. In all sections of the country, except the South Atlantic and Pacific, the incidence was closely approaching the level of the rather normal years 1930 and 1929. The number of cases reported (30) from the Pacific area was 2.5 times that for the same period last year, and in the South Atlantic the number (13) was twice that of last year. Other areas closely approximated last year's incidence.

Mortality, all causes.—The average mortality rate from all causes in large cities as reported by the Bureau of the Census for the 4 weeks ended January 27 was 12.6 per thousand population (annual basis). For this period in the years 1933, 1932, and 1931 the rates were 13.1, 12.3, and 14.5, respectively. The rates for this period in 1933 and 1931 were rather high because of minor influenza epidemics, but the current rate compares favorably with 1932, which was relatively free from influenza in this period.

EFFECT OF FLEA PASSAGE ON EPIDEMIC TYPHUS VIRUS

By R. E. DYER, *Surgeon, United States Public Health Service*

The difference between the reaction of laboratory animals to epidemic typhus virus and endemic typhus virus has been stressed, particularly by Mooser in his reports. In the male guinea pig it is recognized generally that strains of endemic virus produce redness and swelling of the scrotum, while infection of animals of this sex and species with epidemic virus only in rare instances produces this reaction. Furthermore, the scrotal reaction occasionally seen in animals infected with epidemic virus is seldom intense and usually fleeting in character. We have had under observation for several years a strain of epidemic typhus virus which we received from Maxcy in 1929, who, in turn, procured it from Breinl 3 years earlier. Male guinea pigs inoculated with this strain of epidemic virus occasionally show a moderate scrotal redness and swelling which usually disappears in 24 to 48 hours. We have attempted on several occasions to perpetuate this reaction in subsequent passage generations of guinea pigs but have failed except in one instance. In this instance, which occurred in the fall of 1929, a guinea pig killed on the eighth day of fever occasioned by inoculation with the Breinl strain of epidemic virus showed testicles covered with exudate, and hemorrhages in the tunica. The testicles were washed in salt solution and the washings used to inoculate other guinea pigs. These animals and over 80 percent of the 154 guinea pigs used in the succeeding transfer generations showed reactions of the scrotum typical of those caused by endemic typhus virus.

Since we were experimenting with fleas at the time, and in view of the later discovery of the part played by fleas in the transmission of typhus, it seemed possible that, through accident, escaped fleas might have become infected with the Breinl virus and have been responsible for infecting the original guinea pig which showed the typical endemic typhus reaction although he had been inoculated with virus from the Breinl epidemic strain. This explanation would fit in with Mooser's observation that Nicolle's strain of epidemic virus after passage through fleas acquired to some extent the characteristics of an endemic virus.

In view of the foregoing, we passed the Breinl strain of epidemic virus through rat fleas (*Xenopsylla cheopis*) three successive times, carefully observing all guinea pigs inoculated with the virus after each flea passage. In carrying out this experiment we allowed noninfected fleas to feed on white rats which had been inoculated with the Breinl strain of epidemic typhus virus. After allowing for an incubation or multiplication period in the flea, a number of these arthropods were ground up in salt solution and injected into guinea pigs (only male animals being used). The virus was then perpetuated in other guinea pigs for several generations, care being taken to select for transfer any animals which showed any signs of involvement of the scrotum. After the first flea passage, the virus was maintained for 24 passage generations in guinea pigs, a total of 216 guinea pigs being used. These guinea pigs reacted in a manner which was typical of the reaction caused by the original Breinl strain of virus. Virus from this first flea passage strain was used to infect fresh white rats on which fresh noninfected fleas were allowed to feed. The virus was again recovered from these fleas and studied in guinea pigs as before, with the same failure to find evidence of any change in the virus. In the study of this second flea passage virus 168 guinea pigs were used in 15 guinea pig passage generations. After a third passage of the virus through fleas, carried out as before, the virus was maintained in guinea pigs for 14 passage generations (160 guinea pigs) without evidence of variation from the epidemic type. After this last flea passage strain had been maintained in guinea pigs for 12 passage generations it became contaminated with the strain of *S. enteriditis* described by Badger. Guinea pigs having the cross infection with this organism showed scrotal lesions which grossly could not be differentiated from those caused by endemic typhus virus.

CONCLUSION

After passing epidemic typhus virus through fleas three times we were unable to find evidence of change in the type of the virus.

VOLUME CHANGES OF TUMOR CELLS IN VITRO

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Comparatively little attention has been paid to the role of water in the biology of cancer. From analyses of the water content of malignant tumors (Wolter, 1913; Cramer, 1915–16; Robin, 1919*a*; Simonini, 1924; Roffo, 1925; Lewis, 1927; Marvelli, 1930; Cavina, 1931; Morávek, 1932; Guastalla, 1931; Uramoto, 1932; Schlottmann and Rubenow, 1932), it has been concluded that cancerous tissues contain more water than do normal tissues. In addition, Roffo (1930) has reported that neoplastic tissue is more sensitive to dehydration than is normal tissue. Of considerable interest are the reports which indicate that tumor tissue has an imbibition capacity different from that of normal tissue (Robin, 1919*b*; Lasnitzki, 1928; Magath and Kolomijetz, 1930; Roosen, 1932). In most of the papers cited here, the amount of data on the water content of tumors is not impressive; few of them are as comprehensive as the earlier work of Cramer (1915–16). As for reports on other aspects of the role of water in cancer, much of them, aside from the contributions of Magath and his collaborators, is speculative. Nevertheless, these various findings were sufficiently suggestive to warrant investigation of fluid exchange in tumor tissue.

Considerable attention has been devoted to the increase in cell volume, due to increased water inflow, on immersion of cells in solutions. However, most of this type of work has been done with eggs and other cells of invertebrates, and with mammalian red blood corpuscles; but little has been reported with respect to this phenomenon in parenchymatous tissue cells of mammals.

A study of the behavior of mammalian tissue on immersion in solutions was therefore undertaken, with attention focused on changes in cell volume. Obviously, a number of factors are involved in fluid exchange. The permeability of the cell membrane, the tonicity of the external medium and of the cell contents, the imbibition capacity (colloid osmotic pressure) of the cell contents and of the outside solution, the surface tension at the interface, and the intracellular turgor pressure (Duff, 1932; Adolph, 1933) are some of the important factors. Without attempting to separate the part played in fluid exchange by these various factors, the net result of water inflow and outflow upon immersion in various solutions was determined by observation of the cell volume.

Observations were made with both normal and neoplastic tissue. Upon immersion in solution, increase in cell size was noted in a short time. This increase took various forms; sometimes there was a generalized cellular swelling, and sometimes vesicles of clear fluid were protruded from the cells. This phenomenon occurred with both normal and malignant tissues.

Since little is known about the mechanisms which regulate fluid exchange in parenchymatous tissue cells of mammals, this cellular swelling was studied in some detail. The effect of the various constituents of blood fluids upon changes in cell size was determined by a systematic variation of the concentration of each constituent. Tumor tissue provided exceptionally favorable material for such a study, since the cells of young, actively growing tumors regularly exhibited this swelling phenomenon a short time after immersion in solution.

It was found that none of the inorganic constituents or of the simple organic constituents of blood fluids, when used in physiologically possible amounts, produces an inhibiting effect on this increase in volume in tumor cells. The swelling is not due to hypotonicity, for it also occurs in solutions which are definitely hypertonic.

Of course, neither "physiological saline" nor "physiologically balanced salt solution" constitutes a normal environment for mammalian cells; and hence the possibility had to be considered that the swelling noted in inorganic solutions may possibly have resulted from some injury to the cells. Furthermore, when fragments of tissue are excised, the mere separation from contiguous cells may produce some injury; and hence such explanted cells may not be entirely normal. While injury to the cells must be considered as possibly being the cause of the swelling, experiments now in progress raise the question as to whether the reverse may not be the case, i.e., that injury is the result and not the cause of the swelling.

It is only by isolating tissue *in vitro* that the composition of the surrounding fluid can be changed at will and the effect of the changes noted immediately by direct observation of the cells. The information obtained by such procedures may be of value in throwing light on the factors involved in fluid exchange in cells.

PROCEDURE

Fresh tumor tissue was dissected free from necrotic areas and was immediately cut into fragments in the solution to be tested. The pieces were then mounted in a hanging drop of the test solution on a depression slide, and sealed with a vaseline-paraffin mixture, employing the usual tissue-culture technique.

The solutions used for immersion of the fragments were prepared from analyzed reagent chemicals. They were adjusted before using to pH 7, employing a 0.04 percent solution of phenol red as indicator. At first adjustment was made to pH 7.4, but loss of CO_2 during the manipulations brought the pH up to about 8; consequently, the pH was made about 7 to allow for the loss in CO_2 during the preparation of the hanging drop. The swelling was noted over a rather wide pH range; slight variations in pH produced no pronounced effect upon the increase in cell volume (see p. 231). In most cases pH adjustment was made with a stream of air or of CO_2.

In the case of transplanted tumors, only actively growing young tumors were employed. *Unless otherwise stated, the experiments were conducted with mouse sarcoma 180.*

INORGANIC SOLUTIONS

A characteristic behavior was noted in all of the inorganic solutions. A short time after immersion, the cells began to increase in volume. The isolated cells scattered throughout the drop, as well as the cells forming the outer borders of the tissue fragments, exhibited this behavior. Variation of the concentrations of the constituents of the solution within physiological limits did not have an inhibiting effect on the swelling.

The increase in size took various forms. Sometimes there was a uniform, generalized swelling; sometimes the protoplasm occupied one part of the swollen cell and apparently clear fluid occupied the remainder of the cell; but often a portion of the cell wall protruded to form an outpocketing or "bulge." These bulges, or vesicles, at first small in size, increased until they were sometimes larger than the original cell. In many instances the bulge ruptured, with liberation of the cell contents. In some cases, especially with mouse sarcoma 37 and Rous chicken sarcoma, as many as 2, 3, and even 4 bulges were seen protruding from a single cell.

Sometimes a bulge was "pinched off" and formed a spherical "globule" of apparently clear fluid. In such cases, as the bulge grew larger, it remained connected with the cell by a narrow bridge, forming a dumbbell-shaped structure; finally, it parted from the cell to form a spherical globule.

DISTILLED WATER

Pronounced swelling occurred rapidly in distilled water. The pieces of tumor rapidly disintegrated and the gelatinous fragments clumped together. There were many swollen cells and a large amount of cellular debris in a few minutes.

Similar results were obtained with Rous chicken sarcoma.

SODIUM CHLORIDE

In solutions which contained 145 to 155 mM sodium chloride,[1] swollen cells, bulges, and globules began to be in evidence about a half hour after immersion. Sometimes swelling was noted a few minutes after immersion. At the end of 2 hours there were numerous swollen cells and considerable debris from ruptured cells. This process went on until, after several more hours, most of the cells were seen to be affected.

Similar results were obtained with mouse sarcoma 37, spontaneous Buffalo [2] mouse adenocarcinoma, and Rous chicken sarcoma. In the case of sarcoma 37, concentrations of 150, 155, 163, 171, and 180 mM sodium chloride were employed; these solutions were buffered with 1.5 mM of sodium phosphate. Similar results were obtained at all concentrations.

Stronger solutions of sodium chloride (250, 450, and 855 mM, and 1.71 M) produced a strikingly disruptive effect on the explants. Within 10 minutes after immersion the smaller explants were completely disintegrated and the larger pieces of tissue were surrounded with a wide area of innumerable cells and gelatinous debris. The cells were pale and distorted, some showing typical bulges. Globules were numerous. Similar results were noted with mouse sarcoma 37, mouse carcinoma 63, and Rous chicken sarcoma.

[1] 0.85 percent NaCl is 145 mM; 0.90 percent NaCl is 154 mM; 0.95 percent NaCl is 163 mM; 1 percent NaCl is 171 mM; 1.05 percent NaCl is 180 mM; 5 percent NaCl is 855 mM; 10 percent NaCl is 1.71 M.

[2] Obtained from Dr. M. C. Marsh, New York State Institute for the Study of Malignant Diseases, Buffalo, N.Y.

These results were quite the opposite of the picture of a shrunken explant with contracted cells, which might have been expected in strongly hypertonic solutions. These effects appeared to be due not so much to excessive fluid intake as to severe injury produced by the high salt concentrations. It may be that such strong salt solutions exert a destructive effect upon the outer surface of the cell.

INORGANIC SERUM SOLUTIONS

In the preliminary experiments with solutions of relatively low salt concentration, the assumption seemed plausible that the inflow of water might be due to the hypotonicity of the solutions employed. *However, when similar increases in cell volume were observed with definitely hypertonic solutions, it was obvious that it was not a question of tonicity.* The possibility was next considered as to whether any of the common inorganic constituents of blood serum might be important factors in this fluid exchange.

Accordingly, solutions were prepared which approximated the inorganic composition of average blood serum or plasma (*cf.* Peters and Van Slyke, 1931). A total base concentration of 155 milli-equivalents per liter was selected, not because it was considered to be isosmotic with blood fluids but because this is the content of total base present in serum. The composition of our inorganic serum solution was as follows:

Base content of inorganic serum solution

NaCl	112 milli-equivalents per liter
KCl	5 milli-equivalents per liter
$NaHCO_3$	30 milli-equivalents per liter
$CaCl_2$ [a]	3 milli-equivalents per liter
$MgCl_2$	3 milli-equivalents per liter
Na_2HPO_4	2 milli-equivalents per liter
Total base	155 milli-equivalents per liter

Such solutions are best prepared by adding the constituents in the order given, with particular attention paid to the pH. It was found convenient to prepare separate stock solutions of each constituent and to use suitable aliquot portions in making up the mixtures. After the addition of $NaHCO_3$, a stream of CO_2 is bubbled through until the solution becomes yellow to phenol red. Before the addition of phosphate, more CO_2 is run in if the solution is not yellow. Immediately before using the solution in an experiment, a stream of air is bubbled through to remove excess CO_2 until the desired pH is

[a] Although the normal value for serum calcium is 10 mg percent, only about half of it is diffusible. Hence 6 mg percent (3 milli-equivalents per liter), rather than 10 mg percent, has been used here as a closer approximation to the concentration of *ionized* calcium in serum. (For a discussion of the concentration of calcium ions in serum see Shear, 1933.)

attained. Unless precautions are taken to keep such solutions acid when not in use, precipitation of calcium phosphates is likely to occur, especially if the solution is allowed to become more alkaline than pH 7.5 for any considerable length of time before being used.

A number of solutions were prepared in which the amounts of the various constituents were varied slightly from those of the inorganic serum solution. In others, the concentrations of all the constituents were kept constant with the exception of NaCl, which was varied so as to give solutions with a total base content of from 130 to 180 milli-equivalents per liter.

In all of these solutions the usual increase in cell size occurred; there were numerous swollen cells, bulges, and globules an hour or two after immersion. Neither minor variations in the concentrations of the various constituents nor the variations in the total ionic strength stated above had an inhibiting effect on this phenomenon.

The behavior of a number of other types of malignant tumors of various origins was similar to that of mouse sarcoma 180. These results are discussed in a later section (see page 235).

pH

As stated previously, most of the solutions contained bicarbonate, and the adjustment of pH was effected by a stream of CO_2 or of air. To test the effect of varying the acidity, mouse sarcoma 37 was cut up in inorganic serum solution adjusted to pH 5, 7, and 9. Within half an hour swelling began to be noted at all three hydrogen-ion concentrations, and large bulges were obtained in all solutions.

Inasmuch as the pH of such solutions changes toward the alkaline side because of loss of CO_2, the effect of pH variation was more carefully studied by using solutions buffered by phosphate. Solutions were prepared having a composition analogous to the inorganic serum solution except for bicarbonate and chloride—no sodium bicarbonate was present, and additional sodium chloride was added so as to keep the total base constant at 155 milli-equivalents. The buffering was effected by phosphate, which was present in concentrations of 1.5 and 3.0 mM.

The pH of these solutions was varied from 5 to 10, using HCl and NaOH for adjustment. A concentration of 4.7 mg phosphorus per 100 cc was sufficient to maintain the pH constant for hours even when the solution contained a considerable amount of minced tumor tissue. Two types of tumors were studied: mouse sarcomas 180 and 37.

In these solutions, which contained no bicarbonate, swelling with bulging was noted at all hydrogen-ion concentrations between pH 5 and 9. In solutions more alkaline than pH 8.5, disintegration of another sort was common: the "cell wall" seemed to dissolve, leaving a mass of sticky, granular, protoplasmic debris. This was also noticeable macroscopically from the way the tissue fragments in the more alkaline solutions adhered to one another and stuck to the capillary pipette. The greater the alkalinity of the solution, the more rapid and the more pronounced was this type of disintegration.

The characteristic swelling phenomenon, consisting of bulges, globules, and swollen cells with areas of clear fluid, appeared to be somewhat more prevalent in slightly alkaline solution, in the range between pH 7.5 and 8. Minor variations in pH did not seem to have a pronounced effect on the swelling.

Temperature.—A few experiments were performed to see what effect temperature had on this swelling. The process appeared to proceed somewhat more rapidly at 38° C. than at room temperature, but the difference was not striking.

POTASSIUM

As stated above, the concentration of sodium chloride was varied between wide limits without preventing or hindering the swelling. The concentration of each of the other inorganic constituents was then varied systematically from zero to beyond the amount physiologically normal for blood serum, and the effect on swelling was determined. The total base was kept constant in all these solutions by increasing or decreasing the concentration of sodium chloride to compensate for the decreases or increases in concentration of the constituent under study. In all of the experiments, some of the tumor tissue was mounted in the inorganic serum solution for comparison.

A series of 6 solutions was prepared with a composition analogous to that of the inorganic serum solution, except that the potassium content was varied from 1 to 18 mM. With potassium concentrations up to 9 mM, the usual swelling, accompanied by bulges and globules, was noted; with 12 mM potassium only a few cells were swollen; with 18 mM potassium negative results were obtained as far as the swelling was concerned.

(The normal[3] amount of potassium in serum is 5 mM.)

CALCIUM

A series of five solutions was prepared which differed from the inorganic serum solution only in calcium content, which was varied from 0 to 4.5 mM. Swelling was obtained in all solutions.

(The normal [3] calcium-ion concentration of serum is believed to be not greater than about 1.5 mM. See also footnote on page 229.)

MAGNESIUM

In a similar fashion the magnesium content was varied between 0 and 4.0 mM, the other constituents of these four solutions being kept at the same concentration as in the inorganic serum solution. Swelling was obtained in all four solutions.

(The normal[3] magnesium content of serum is about 1.5 mM.)

[3] The normal values for these constituents are those given by Peters and Van Slyke (1931) for man.

BICARBONATE

Six concentrations of bicarbonate were employed: 0, 10, 20, 30, 40, and 60 mM. The other constituents were the same as in the inorganic serum solution. The usual swelling was observed at all concentrations.

(The normal [3] bicarbonate content of serum is about 30 mM.)

PHOSPHATE

In an analogous fashion the phosphate content was varied from 0 to 4.0 mM. At all of the six phosphate concentrations the typical swelling phenomena were noted.

(The normal [3] serum phosphorus varies from about 1 to 2.5 mM, depending upon the age of the individual.)

OTHER INORGANIC SOLUTIONS

On immersion in Ringer solution, Locke solution, Ringer-Locke solution, Tyrode solution, and Drew solution, the same phenomena were observed.

A solution was made up similar to Locke solution, except that all the constituents were present in 10 times the usual concentration. The cells were rapidly affected in a manner similar to that previously noted in strong NaCl solutions.

SIMPLE ORGANIC CONSTITUENTS

Since none of the inorganic constituents of serum, when varied within physiological limits, appeared to have an inhibiting effect on swelling, the effect of the simple organic constituents of blood serum was studied. These organic compounds were added, in varying amounts, to solutions that had the same inorganic composition as the inorganic serum solution. They thus constituted closer approximations to the composition of blood serum than did the purely inorganic solutions. In all cases, simultaneous experiments were done with inorganic serum solution for purposes of comparison.

GLUCOSE

Four solutions were prepared containing the following amounts of glucose: 0, 75, 150, and 250 mg per 100 cc. The usual swelling effects were noted.

(The normal [3] value for glucose is variously given as 75 to 100 mg percent, depending upon the method used.)

UREA

Four solutions were prepared containing 0, 19, 38, and 57 mg percent of urea nitrogen, respectively. Swelling occurred in all solutions.

(The normal [3] value for urea nitrogen is 19 mg percent.)

[3] The normal values for these constituents are those given by Peters and Van Slyke (1931) for man.

AMINO-ACID

Four solutions were prepared containing 0, 6, 12, and 18 mg percent nitrogen in the form of cysteine. Swelling occurred in all solutions.

(The normal[3] value for amino-acid nitrogen is 6 mg per 100 cc.)

URIC ACID

Four concentrations of uric acid (0, 4, 7.5, and 10.9 mg uric acid per 100 cc) were tested. Swelling was noted in all solutions.

(The normal[3] value for uric acid is 4 mg per 100 cc.)

OTHER SOLUTIONS

Solutions were next prepared which contained, in addition to the inorganic constituents, these four organic compounds in various proportions.

Such solutions, because of the presence of the organic compounds, reproduce physiological conditions more closely than does the inorganic serum solution. The most complete of these solutions had the following composition:

Artificial serum solution

	mM
Glucose, 75 mg per 100 cc	4. 2
Urea, 40 mg per 100 cc	6. 7
Amino-acid nitrogen,[4] 6 mg per 100 cc	4. 3
Uric acid, 4 mg per 100 cc	0. 24
NaCl, 655 mg NaCl per 100 cc	112
KCl, 19.5 mg K per 100 cc	5
$NaHCO_3$, 183 mg HCO_3 per 100 cc	30
$CaCl_2$, 6 mg Ca per 100 cc	1. 5
$MgCl_2$, 3.6 mg Mg per 100 cc	1. 5
Na_2HPO_4, 3.1 mg P per 100 cc	1

In all instances, the usual swelling, with bulges and globules, was observed.

SERUM AND PLASMA

SERUM

Mouse serum was diluted with inorganic serum solution in various proportions, and the solutions were then tested for their effect on the swelling of mouse sarcoma 180. The concentration of serum was varied from 10 to 100 percent. Swelling, accompanied by bulging and globule formation, occurred at all dilutions, but at a much slower rate than in the solutions previously described.

The effect of undiluted serum was not studied in detail—only a few experiments were carried out. Mouse carcinoma 63 was cut up in

[3] The normal values for these constituents are those given by Peters and Van Slyke (1931) for man.

[4] In the form of 67.5 mg per 100 cc of cysteine hydrochloride, or 63 mg per 100 cc of d-glutamic acid. The former was used because of its oxidation-reduction properties; the latter was employed as a control. Other amino-acids may be employed in their stead.

normal mouse serum and in immune mouse serum;[6] little evidence of swelling was obtained in either serum in 2 hours. Sarcoma 180 cut up in dog serum showed little sign of swelling in 2 hours; it was only at the end of 10 hours that globules and bulges were frequent. Rous chicken sarcoma in dog serum showed no sign of swelling in 6 hours. Sarcoma 180 in horse serum did not show much evidence of swelling until 5 hours had elapsed.

The few experiments performed with various tumors cut up in various types of sera showed that the swelling of cells, accompanied by bulge and globule formation, occurred at a considerably slower rate than in the solutions previously described.

PLASMA

When tumor tissue was immersed in heparinized mouse plasma, results were obtained which were entirely different from those noted in serum. When undiluted plasma was used, the entire preparation clotted as soon as the tissue was cut up in it. When plasma diluted with inorganic serum solution was used, clot formation also occurred, but to a lesser extent. In solutions containing 15 percent or more of plasma, the tumor explants were surrounded in a few minutes with a layer of transparent clot. In solutions which contained less than 15 percent plasma, a clot of appreciable width did not always form about the explant, but the presence of a restraining film of clot was shown by the regularity of the borders of the explants. This regularity was characteristic; for in serum, as in the solutions described in preceding sections, the borders of the explant were irregular and numerous individual cells were scattered throughout the liquid.

In solutions which contained considerable amounts of plasma, a wide clot was noted surrounding the explant, while in dilute plasma solutions a thin film of clot was obtained. When the film was quite thin, it was occasionally noted to rupture in a few places. When this happened the cells which were exposed to the solution showed the usual swelling, accompanied by bulges and globules.

The formation of this clot was but slightly affected by urea, which was employed because of its solvent effect on fibrin (Foulger and Mills, 1930; Menkin, 1932). Plasma, diluted with equal volume of inorganic serum solution, was compared with a similar 50 percent plasma solution which contained 5 g of urea per 100 cc; the clot formed in the urea solution, but it was less readily made out, apparently because it was less dense. Stronger urea solutions, such as those used by the above-mentioned investigators, would most probably have prevented clot formation, but it was considered inadvisable to employ high urea concentrations for fear of injuring the exposed cells.

[6] Mice immune to sarcoma 180, and hence to carcimona 63 as well, were furnished by Dr. H. B. Andervont (1932) of this laboratory.

When citrate was used, however, the formation of clot was inhibited. Plasma was diluted with an equal volume of inorganic serum solution to which had been added $2Na_3C_6H_5O_7 \cdot 11H_2O$. No clot formed around the tumor explants in 50 percent plasma solutions when they contained 1.0, 1.5, or 2.0 g of sodium citrate per 100 cc. In such solutions, the borders of the explants were irregular and swelling of the cells occurred, as in serum.

The limiting concentration was 0.5 percent sodium citrate. At this strength some of the borders of the explants were irregular, as in serum, while other borders were smooth, indicating the presence of a narrow film of clot. When 0.25 g of sodium citrate was present per 100 cc of the plasma solution, a definite clot was noted in a few minutes around the tumor fragments.

Thus, the formation of clot about sarcoma 180 in 50 percent plasma solutions may be inhibited by the use of 0.5 percent or more of sodium citrate.

Mouse carcinoma 63 behaved in mouse-plasma solutions in a similar fashion. Sarcoma 180 gave the same results in dog-plasma solutions as in mouse-plasma solutions.

OTHER TUMORS

A number of different types of tumor, obtained from various species, were tested by immersion in the inorganic serum solution. In many instances, several tumors of each type were tested; in others, only one tumor was available. In all instances swelling of the cells, accompanied by bulge formation, occurred in a short time.

The types of tumor so tested are listed in the following table:

Tumor	Source	Comment
Sarcoma 180	Albino mouse	Swelling.
Carcinoma 63	do	Do.
Carcinoma 27	do	Do.
Carcinoma 206	do	Do.
Sarcoma 37	do	Many cells with more than 1 bulge.
Do	Brown mouse [a]	Do.
Spontaneous Buffalo carcinoma	Albino mouse	Swelling.
Transplanted Buffalo carcinoma	do	Do.
Spontaneous carcinoma	Brown mouse [a]	Do.
Transplanted carcinoma	do	Do.
Spontaneous carcinoma	Albino mouse	Do.
Rous sarcoma	Chicken	Many cells with more than 1 bulge.
Rous sarcoma metastases	do	Do.
Transplanted carcinoma	Rat	Swelling.
Spontaneous mammary tumor [b]	Dog	Do.
Mammary carcinoma	Human	Do.
Gastric carcinoma	do	Do.
Rectal carcinoma	do	Do.
Pituitary carcinoma	do	Do.

[a] Pure C3H strain obtained from Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.
[b] Benign tumor.

These tumors all showed the characteristic increase in cell volume on immersion in the inorganic serum solution.

DISCUSSION

Since the swelling of cells of parenchymatous tissues of mammals upon immersion in solutions does not appear to have been previously studied, a number of normal tissues of the mouse were examined from this point of view. Cellular swelling was seen to occur in several of them. Of the normal material examined, swelling was most pronounced in spleen, testes, and in embryo tissues.

Hence the swelling phenomenon described in this paper is not an exclusive characteristic of tumor cells only. While the swelling has been noted with normal tissues, the rapidity and extent to which it occurs does not appear to be the same for all tissues. Consequently, until some quantitative method for estimating the rate and degree of swelling is devised, it cannot be definitely stated that there is a characteristic difference between normal and tumor tissue in this respect.

The swelling reported in this paper is not to be ascribed to hypotonicity of the solutions employed, for it occurred regularly in solutions that were definitely hypertonic. Incidentally, it was interesting to note that, alongside of the tumor cells that were taking in water and increasing in size, numerous red blood cells were in various stages of crenation.

The swelling may possibly be due to a high imbibition capacity of the colloids contained in the cells. This possibility is indicated by some other experiments now in progress in which the swelling of tumor tissues was offset by immersion in concentrated protein solutions; such solutions have high colloid osmotic pressures. When dilute solutions were employed, swelling of the cells occurred; as the concentration of protein was increased, less swelling was noted; and in the most concentrated solutions the cells seemed to have become shrunken.

The formation of clot in solutions which contain plasma may possibly account, in part, for the success which investigators have had in culturing tumor tissue *in vitro* in plasma media. Even when only a small amount of plasma is present, a thin clot is formed. Sometimes the clot is a film so thin as to elude observation as such, and its presence is made known only by the behavior of the explant. In serum solutions, the cells swell and are destroyed; in plasma solutions, no swelling is noted except when the clot ruptures. The failure on the part of many workers to obtain satisfactory culture of tumor tissue in serum and serum solutions may possibly be due in part to the swelling which occurs in such culture media.

Lumsden (1931), working with mouse carcinoma 63, observed that anti-M_{63} serum produced a shrinkage of the cell contents into a ringlike mass with irregularly crenated border, but that "outside this a second outline is seen composed of the cell wall bellied out by endosmosis, which is sometimes so intense as to burst the cell membrane." Although neither normal nor neoplastic tissues of mammals appear to have been studied from the point of view of cellular swelling, more is known in this regard about chick embryo tissue. Cash (1919), in studying the effect of ether vapor on explants of chick embryo tissues, noted clear, homogeneous vesicles bulging out at points on the surface of the cell.

Apparently Hogue (1919) was the first to study in detail the effect of hypotonic and hypertonic solutions upon individual cell structures with the aid of tissue-culture technique. Hogue employed embryonic chick heart in her investigation and made observations which were similar in a number of respects to those reported in this paper. The inflow of water which Hogue observed was not due to hypotonicity, for the vacuoles (blebs, vesicles, bulges) were also obtained in *hypertonic* solutions. Hogue noted "balloon-like structures * * * which formed along the edges of the culture * * *. Upon close observation these structures were seen to begin as small hemispheres rising out of the explant. In time they became almost spherical and increased in size as though something from the tissue was being poured into them."

Another type of structure, which Hogue called "granular hills", was also noted: "They grew in size, sometimes becoming quite large, though they were most frequently seen as small balls or hills along the edges or between the angles of the tissue. They were very finely granular. Sometimes the surface tension would be taxed too much and the granular hill would break open at one place, pouring the fine granules into the surrounding medium." Drawings of these structures were given. In the case of tumor tissue we have made similar observations, i.e., the bulges and globules sometimes contained granular material instead of the usually apparently clear fluid.

Hogue discussed the question as to whether these structures were composed of the same material that Burrows and Neymann (1917) noted. It seems to us, however, that the structure observed by Burrows and Neymann is probably akin to the fibrin clot described in a preceding section of this paper, since they stated that "A cell brought in contact with the surface of this transparent substance adheres to it and flattens over its surface." This is what we have repeatedly noted at the outer edges of the fibrin clot which forms about the explant in plasma solutions.

Similar phenomena in swelling cells were observed by Loeb and Blanchard (1922), who investigated the effect of solutions of various neutral salts on cells, using the tissue-culture technique. They studied the effect of a number of salts, with and without the addition of acid or alkali, on the volume of Limulus cells. In the cells of this invertebrate they noted swelling, "balloons", and other structures analogous to those described by Hogue.

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W. H. Lewis (1923) observed chick-embryo cells in tissue cultures by means of dark-field illumination, and noted "spherical blebs" on the cells. "The blebs varied in size and were occasionally as large as a contracted cell * * *. Frequently one would burst, freeing its granular contents into the surrounding fluid medium * * *." In studying reversible gelation in living chick-embryo cells, M. R. Lewis (1923) noticed "fluid blebs" along the edges of cells.

Rosenfeld (1932) confirmed the findings which Cash (1919) reported on the action of ether on cells. Similar "clear vesicular blebs, granular bulbous processes, rounded pseudopods" were noted, in which "No visible membrane can be distinguished at the periphery."

It is the consensus of opinion that these increases in cell volume, with the development of these characteristic cell structures, are due to disturbed fluid exchange, i.e., more water flows into the cells than flows out, with a consequent progressive increase in cell volume. The question arises as to whether this swelling phenomenon occurs only in dead cells or whether it occurs in live cells and is itself the cause of cell death.

Explants of sarcoma 180 are not killed by immersion for 1½ hours in Tyrode solution, although swelling is evident by that time. Hanging drops were prepared, and at the end of 1½ hours, when swelling of the cells was evidenced by the appearance of bulges and globules, the pieces of tissue were transferred to plasma clots according to the usual tissue-culture technique. All five of the explants were alive the next day. This demonstrated that, although swelling had occurred, the explants were not killed.

According to Hogue, the blebs form *before* the cell dies. In hypotonic Lewis-Locke solution, Hogue found that "the cells frequently become swollen with the intake of water as soon as they have been treated with the hypotonic solution. They remain in this condition for an hour or so, until the cell has begun to undergo the changes following death, when they show shrinkage." In hypertonic Lewis-Locke solution, explants of chick-embryo heart, on which the "balloons and granular hills" appeared, would often continue to beat for several days. Blebs began to form while the cells were still alive, for blebs were noted in cells in which the granules alone were stained with neutral red.

Since the bulges and globules have a refractive index that is very close to that of water, and since the "membrane" between the two phases is so delicate, these structures may readily escape notice unless especial search is made for them. A number of vital stains were employed in an attempt to render them more obvious, without conspicuous success. The development of these structures was not inhibited, in general, when vital stains were present; with some stains the bulges and globules were seen to take up a small amount of dye. No particular stain has, up to the present, been found to be strikingly helpful in this respect. The best results were obtained with neutral red. After staining the tumor fragments on the cover slip with some of the test solution to which neutral red had been added, the colored solution was removed by washing several times and replacing with colorless test solution. In this way the bulges and globules were seen faintly pink in a colorless medium.

None of the inorganic or organic substances described in this report, when used within physiological limits, was found to affect the swelling of cells. The swelling in serum, however, occurred at a much slower rate than in the solutions. This suggested that proteins might be a controlling factor in this fluid exchange. The effect of proteins was consequently studied. The results will be presented in a subsequent report.

SUMMARY

1. Explants of normal and tumor tissues were exposed to solutions and the changes in cell volume observed by means of the hanging-drop technique. Cellular swelling was noted with both types of tissue.

2. Employing tumor tissue as experimental material, the effect of the inorganic and simple organic constituents of blood serum upon cellular swelling was determined by systematically varying the concentration of each constituent. When varied within physiological limits, none of these constituents prevented swelling.

3. The swelling occurred in hypertonic solutions as well as in isotonic and hypotonic solutions.

4. The significance of this phenomenon is discussed together with similar observations reported by others on nonmammalian tissue cells.

BIBLIOGRAPHY

Adolph, E. F.: Physiol. Rev., **13**, 336–71 (1933).
Andervont, H. B.: Pub. Health Rep., **47**, 1859–77 (1932).
Burrows, M. T., and Neymann, C. A.: J. Exp. Med., **25**, 93–108 (1917).
Cash, J. R.: Anat. Rec., **16**, 146 (1919).
Cavina, C.: Tumori, **17**, 27–32 (1931).
Cramer, W.: J. Physiol., **50**, 322–34 (1915–16).
Duff, P. A.: Proc. Soc. Exp. Biol. Med., **29**, 508 (1931–32).
Foulger, J. H., and Mills, C. A.: Am. J. Physiol., **94**, 51–9 (1930).
Guastalla, R.: Cancro, **2**, 98 (1931); abstract in Am. J. Cancer Abstracts, **16**, 286 (1932).
Hogue, M. J.: J. Exp. Med., **30**, 617–48 (1919).
Lasnitzki, A.: Z. Krebsforsch., **27**, 115–24 (1928).
Lewis, M. R.: Bull. Johns Hop. Hosp., **34**, 373–9 (1923).
Lewis, W. C. M.: J. Cancer Res., **11**, 16–53 (1927).
Lewis, W. H.: Anat. Rec., **26**, 15–29 (1923).
Loeb, L., and Blanchard, K. C.: Am. J. Physiol., **60**, 277–307 (1922).
Lumsden, T.: Am. J. Cancer, **15**, 563–640 (1931).

Magath, M. A., and Kolomijetz, M. J.: Z. Krebsforsch., **30**, 457–72 (1930).
Marvelli, W.: Tumori, **16**, 212–20 (1930).
Menkin, V.: J. Exp. Med., **56**, 157–72 (1932).
Morávek, V.: Z. Krebsforsch., **35**, 492–508 (1932).
Peters, J. P., and Van Slyke, D.D.: Quantitative Clinical Chemistry, vol. I. Baltimore, The Williams & Wilkins Co. (1931).
Robin, A.: Bull. Acad. Med., **81**, 699–711 (1919*a*).
Robin, A.: Compt. Rend. Acad. Sci., **168**, 1071–2 (1919*b*).
Roffo, A. H.: Néoplasmes, **4**, 65–72 (1925).
Roffo, A. H.: Bol. Inst. Med. Experim., **1**, 936–44 (1930).
Roosen, R.: Z. Krebsforsch., **36**, 561–2 (1932).
Rosenfeld, M.: Arch. exp. Zellforsch., **12**, 570–86 (1932).
Schlottmann, H., and Rubenow, W.: Z. Krebsforsch., **36**, 120–5 (1932).
Shear, M. J.: Am. J. Cancer, **18**, 924–1024 (1933).
Simonini, R.: Clin. Pediatr., **6**, 1–13 (1924).
Uramoto, M.: J. Biochem., **16**, 69–82 (1932).
Wolter, B.: Biochem. Z., **55**, 260–5 (1913).

COURT DECISION RELATING TO PUBLIC HEALTH

City ordinance regulating barbering, beauty culture, and manicuring upheld.—(Virginia Supreme Court of Appeals; *Ransone, Health Officer,* v. *Craft et al.,* 170 S.E. 610; decided Sept. 21, 1933.) Certain barbers filed a bill in equity challenging the validity of an ordinance of the city of Roanoke, which imposed requirements governing barbers, beauty culturists, and manicurists. The lower court declared the ordinance void and enjoined the city health officer from enforcing any of its provisions, and from the decree an appeal was taken.

One of the grounds upon which the trial court based its conclusion was that the State board of health, under statutory authority, had made regulations on the same subject, with which the ordinance was in conflict and, therefore, void. The appellate court said that the bill of complaint did not allege that the ordinance was in conflict with any regulation adopted by the State board of health and that there was nothing in the record on which to base the statement in the trial judge's opinion that the two were in conflict. Under these circumstances the finding of the trial court on the point was not sustained.

Another ground upon which the trial court based its conclusion was that the legislature had passed no general law empowering municipalities to adopt regulations of the kind in question and that the ordinance was a private, special, and local law and within the inhibition of section 65 of the State constitution. The appellate court, after quoting several excerpts from the charter of the city of Roanoke, including some relating to the preservation of health and the prevention of the introduction or spread of communicable diseases, said:

> It appears from these provisions, if valid, of the city charter that the city counsel [council] had express authority to pass an ordinance regulating such trade or calling. However, it was held by the trial court that the general assembly

was prohibited by section 65 of the Virginia constitution from delegating any such authority to the municipality except by general law and that the legislature had passed no general statute on the subject. In other words, that the provisions of the city charter quoted above constituted "local and special legislation", applicable only to the city of Roanoke, and, for that reason, such grant of power was within the prohibition of section 65. It has been repeatedly held by this court that charters of municipal corporations or amendments thereto, conferring rights and powers different from and in addition to those conferred by general statutes, are authorized by the constitution when enacted in accordance with article 4 (secs. 40–68) and section 117 of the constitution. [Citations.]

Continuing, the court said:

In the absence of evidence to the contrary, there is a prima facie presumption that the charter or an amendment thereof was enacted in the manner required by the constitution and that the rights and powers conferred are within the legislative power to grant. There is not a suggestion in the record tending to show that the charter of the city of Roanoke was not enacted in the manner required by article 4 and section 117 of the constitution.

The charge that the provisions of the ordinance were harsh, unreasonable, and arbitrary was said by the appellate court to be made in very general terms and with no proof offered to support the allegation, and the court did not feel constrained to analyze each section to find one provision of doubtful value or which might under some circumstances work a possible hardship. The court stated that some evidence introduced by complainants tended to show that a compliance with the ordinance would require an outlay for each shop in excess of $100, but went on to say that a careful analysis of the evidence and of the ordinance itself clearly showed that a compliance did not necessarily require an outlay for each operator of more than $10. "When the object sought to be obtained is considered", said the court, "it cannot be said that this requirement is either unreasonable or arbitrary."

The decree of the lower court was reversed and final decree entered for the respondent health officer.

DEATHS DURING WEEK ENDED JANUARY 27, 1934

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

	Week ended Jan. 27, 1934	Corresponding week, 1933
Data from 86 large cities of the United States:		
Total deaths	8,758	8,913
Deaths per 1,000 population, annual basis	12.2	12.4
Deaths under 1 year of age	559	665
Deaths under 1 year of age per 1,000 estimated live births	52	[1] 57
Deaths per 1,000 population, annual basis, first 4 weeks of year	12.6	13.1
Data from industrial insurance companies:		
Policies in force	67,571,562	69,080,905
Number of death claims	14,695	16,666
Death claims per 1,000 policies in force, annual rate	11.3	12.6
Death claims per 1,000 policies, first 4 weeks of year, annual rate	11.0	11.8

[1] Data for 81 cities.

PREVALENCE OF DISEASE

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

UNITED STATES

CURRENT WEEKLY STATE REPORTS

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

Reports for Weeks Ended Feb. 3, 1934, and Feb. 4, 1933

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 3, 1934, and Feb. 4, 1933

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933
New England States:								
Maine	2	2	1	1,025	1		1	1
New Hampshire		1			228	1	0	0
Vermont		6			26		0	0
Massachusetts	12	33		56	2,228	197	2	2
Rhode Island	1	5	1	19	2		0	0
Connecticut	3	11	4	210	34	157	1	1
Middle Atlantic States:								
New York	55	55	[1] 24	[1] 81	717	1,815	3	11
New Jersey	27	22	32	278	223	641	1	1
Pennsylvania	100	98			1,743	1,099	3	3
East North Central States:								
Ohio	63	62	121	44	383	528	1	0
Indiana	40	46	88	116	702	16	2	2
Illinois	33	48	17	67	337	179	9	14
Michigan	12	24	2	37	43	504	0	2
Wisconsin	6	3	73	754	808	244	2	3
West North Central States:								
Minnesota	8	8		6	164	754	0	2
Iowa [2]	12	13	15		49		0	2
Missouri	51	34	15	30	1,120	282	2	4
North Dakota	2	4	5	699	130	55	0	0
South Dakota	1	1		8	579	3	0	0
Nebraska	15	9	35	276	88	17	0	1
Kansas	7	8	3	26	52	172	1	6
South Atlantic States:								
Delaware	4	3		13	213		0	0
Maryland [2]	12	11	28	328	174	6	1	1
District of Columbia	13	5	1	4	215	4	0	0
Virginia	33	20			675	106	4	3
West Virginia	26	10	101	379	33	310	0	0
North Carolina	31	36	68	406	2,926	316	2	3
South Carolina [3]	9	17	808	2,286	377	74	0	1
Georgia [3]	21	18		571	938	2	3	1
Florida [3]	12	7	5	55	63	5	0	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 3, 1934, and Feb. 4, 1933—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933
East South Central States:								
Kentucky	51	23	42	69	159	-------	1	4
Tennessee	11	13	126	277	806	18	2	0
Alabama [3]	21	23	158	234	204	12	1	1
Mississippi [3]	16	18	-------	-------	-------	-------	1	0
West South Central States:								
Arkansas	14	2	38	235	473	10	0	0
Louisiana	17	14	10	44	33	11	0	1
Oklahoma [4]	38	13	109	498	393	-------	1	8
Texas [3]	139	100	452	597	991	558	3	2
Mountain States:								
Montana	3	5	42	576	8	187	0	0
Idaho	-------	4	-------	4	97	88	0	0
Wyoming	-------	-------	-------	8	51	30	0	0
Colorado	3	2	-------	76	35	7	0	0
New Mexico	13	13	1	52	60	3	0	0
Arizona	1	-------	18	24	21	4	1	1
Utah [3]	1	-------	-------	-------	938	1	0	0
Pacific States:								
Washington	2	11	-------	1	399	9	3	1
Oregon	1	7	26	117	51	57	0	0
California	39	44	45	294	1,129	312	5	3
Total	981	912	2,514	10,880	21,119	8,794	56	85

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933
New England States:								
Maine	1	0	18	41	0	0	2	5
New Hampshire	0	0	18	25	0	0	0	0
Vermont	0	0	20	16	0	0	0	0
Massachusetts	0	0	250	328	0	0	2	3
Rhode Island	0	0	15	31	0	0	0	0
Connecticut	0	0	68	149	0	4	0	1
Middle Atlantic States:								
New York	0	2	726	1,052	0	0	4	10
New Jersey	0	1	178	304	0	0	1	3
Pennsylvania	0	0	812	1,038	0	0	16	6
East North Central States:								
Ohio	1	1	823	518	0	22	8	5
Indiana	0	1	264	122	0	2	2	7
Illinois	2	1	493	475	3	16	6	9
Michigan	1	1	466	443	0	3	0	3
Wisconsin	0	0	183	177	35	8	2	0
West North Central States:								
Minnesota	0	0	67	69	3	0	0	0
Iowa [3]	0	0	77	34	9	24	3	1
Missouri	1	0	165	117	10	1	1	6
North Dakota	0	0	40	18	0	0	0	0
South Dakota	0	0	18	21	0	0	0	1
Nebraska	0	0	36	24	1	6	0	1
Kansas	1	2	146	61	5	1	1	4
South Atlantic States:								
Delaware	0	0	19	10	0	0	0	1
Maryland [3]	0	0	78	83	0	0	4	3
District of Columbia	0	0	14	13	0	0	0	1
Virginia	1	0	76	32	0	0	3	4
West Virginia	2	1	79	39	4	0	5	4
North Carolina	0	0	76	33	0	1	0	4
South Carolina [3]	0	0	8	4	0	0	4	0
Georgia [3]	0	0	9	14	0	0	10	5
Florida [3]	0	0	7	5	0	0	1	2

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 3, 1934, and Feb. 4, 1933—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933	Week ended Feb. 3, 1934	Week ended Feb. 4, 1933
East South Central States:								
Kentucky	0	0	106	48	1	0	1	5
Tennessee	1	0	54	21	0	3	8	10
Alabama [3]	0	0	20	27	0	2	4	4
Mississippi [2]	0	0	32	13	2	0	5	3
West South Central States:								
Arkansas	0	1	12	13	1	7	1	1
Louisiana	1	0	26	8	1	0	7	3
Oklahoma [4]	0	0	29	26	0	8	13	0
Texas [3]	0	0	145	72	17	28	17	4
Mountain States:								
Montana	0	0	25	26	0	1	1	1
Idaho	0	0	15	6	1	18	0	0
Wyoming	0	0	8	3	5	0	0	0
Colorado	1	0	43	46	11	0	0	1
New Mexico	0	0	34	9	0	0	3	1
Arizona	0	0	1	4	1	0	0	0
Utah [2]	0	0	7	15	1	0	0	0
Pacific States:								
Washington	1	0	46	44	0	4	3	1
Oregon	0	0	60	15	7	1	0	2
California	3	1	301	237	13	34	6	12
Total	17	12	6,213	5,929	131	194	144	137

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 3, 1934, 19 cases, as follows: South Carolina, 2; Georgia, 9; Florida, 1; Alabama, 5; Texas 2.
[4] Exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

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

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
December 1933										
Kansas	2	133	4	2	149		2	507	19	10
New Hampshire		2	4					77	0	4
Tennessee	7	225	324	138	830	11	0	488	12	35
Texas	1	1,045	679	4,242		39	5	591		144
January 1934										
Connecticut	2	20	79		69		1	281	0	1
Delaware	1	20	3		195		1	50	0	1
District of Columbia		118	14		576	1	0	70	0	2

December 1933

	Cases
Chicken pox:	
Kansas	891
Tennessee	321
Dysentery:	
Kansas (amoebic)	11
Tennessee	6
German measles:	
Kansas	4
Tennessee	15
Hookworm disease:	
Tennessee	2

December 1933—Continued

	Cases
Impetigo contagiosa:	
Kansas	1
Tennessee	9
Lethargic encephalitis:	
Kansas	4
Tennessee	1
Texas	13
Mumps:	
Kansas	178
Tennessee	100

December 1933—Continued

	Cases
Ophthalmia neonatorum:	
Tennessee	4
Paratyphoid fever:	
Kansas	2
Texas	4
Puerperal septicemia:	
Tennessee	1
Scabies:	
Tennessee	34
Septic sore throat:	
Kansas	4
Tennessee	13

December 1933—Continued

Tetanus:	Cases
Kansas	3
Tennessee	1
Trachoma:	
Tennessee	21
Tularaemia:	
Kansas	2
Tennessee	2
Undulant fever:	
Kansas	10
Tennessee	2
Vincent's infection:	
Kansas	1
Tennessee	4
Whooping cough:	
Kansas	434
Tennessee	118

January 1934

Anthrax:	Cases
Delaware	1
Chicken pox:	
Connecticut	713
Delaware	43
District of Columbia	86
Conjunctivitis:	
Connecticut	48
Dysentery:	
Connecticut (amoebic)	1
German measles:	
Connecticut	7
Lethargic encephalitis:	
Connecticut	4
District of Columbia	2

January 1934—Continued

Mumps:	Cases
Connecticut	618
Delaware	1
Ophthalmia neonatorum:	
Connecticut	3
Rabies in animals:	
Connecticut	3
Septic sore throat:	
Connecticut	12
Trichinosis:	
Connecticut	1
Undulant fever:	
Connecticut	1
Whooping cough:	
Connecticut	213
Delaware	28
District of Columbia	90

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 27, 1934

[This table summarizes the reports received regularly from a selected list of 121 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table]
Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

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								
Maine:											
Portland	0		0	0	3	3	0	0	0	9	23
New Hampshire:											
Concord	0		0	16	2	0	0	1	0	0	11
Manchester	0		2	0	3	0	0	1	0	0	16
Nashua	0		0	0	0	3	0	0	0	2	
Vermont:											
Barre	0		0	0	0	0	0	0	0	0	4
Burlington	0		0	0	0	4	0	0	0	10	14
Massachusetts:											
Boston	3		0	326	28	66	0	15	1	89	251
Fall River	1		0	0	2	4	0	3	0	1	25
Springfield	0		0	3	1	3	0	0	0	30	29
Worcester	0		0	107	5	10	0	0	0	15	47
Rhode Island:											
Pawtucket	1		0	0	0	2	0	0	0	0	0
Providence	2		2	0	9	7	0	0	1	10	73
Connecticut:											
Bridgeport	0	1	1	0	1	18	0	1	0	0	38
Hartford	0	1	0	0	4	6	0	0	0	1	49
New Haven	0		0	0	4	3	0	1	0	2	50
New York:											
Buffalo	0		0	206	12	28	0	5	0	21	137
New York	42	25	18	35	173	266	0	88	2	97	1,560
Rochester	0		0	0	6	16	0	1	0	8	75
Syracuse	0		0	1	8	2	0	1	0	41	56
New Jersey:											
Camden	1		0	14	4	13	0	0	1	0	31
Newark	0	5	0	3	9	25	0	4	0	23	107
Trenton	0	3	0	2	3	22	0	2	1	6	45
Pennsylvania:											
Philadelphia	1	11	5	664	50	92	0	29	2	61	549
Pittsburgh	10	1	2	8	22	31	0	7	2	56	166
Reading	0		0	12	1	5	0	0	0	14	16
Scranton	0		0	0	0	7	0	0	0	1	
Ohio:											
Cincinnati	2		2	237	9	23	0	9	1	32	122
Cleveland	6	45	3	1	19	69	0	11	0	91	194
Columbus	3	6	7	1	9	28	0	2	0	32	99
Toledo	2	4	4	90	5	58	0	1	0	49	66
Indiana:											
Fort Wayne	6		0	0	2	9	0	1	0	0	16
Indianapolis	2		2	31	18	8	0	5	0	29	
South Bend	0		0	0	0	5	0	0	0	1	13
Terre Haute	0		0	51	0	2	0	0	0	0	17

City reports for week ended Jan. 27, 1934—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								
Illinois:											
Chicago	2	5	4	31	47	276	0	41	1	165	708
Springfield	2	4	1	5	9	5	0	0	0	4	25
Michigan:											
Detroit	8	2	4	7	30	132	0	20	0	112	270
Flint	2		0	6	3	53	0	1	1	2	26
Grand Rapids	0		2	0	0	11	0	2	0	0	38
Wisconsin:											
Kenosha	0		0	0	0	18	0	0	0	6	6
Milwaukee	2		0	5	8	55	0	5	0	116	85
Racine	1		0	2	0	11	0	0	0	3	11
Superior	0		0	1	1	0	0	1	0	1	8
Minnesota:											
Duluth	0		0	1	2	0	0	1	2	0	17
Minneapolis	2		1	5	19	17	0	4	2	16	109
St. Paul	0		0	0	15	7	0	1	0	10	85
Iowa:											
Des Moines	0			1		23	0		0	0	34
Sioux City	2			2		1	0		0	2	
Waterloo	0			0		0	0		0	2	
Missouri:											
Kansas City	1		0	1	21	26	0	5	0	9	107
St. Joseph	0		0	1	9	2	0	0	0	0	45
St. Louis	27	1	1	432	14	24	1	9	2	46	236
North Dakota:											
Fargo	0		0	103	0	0	0	0	0	2	1
Grand Forks	0		0	1	0	0	0	0	0	1	
South Dakota:											
Aberdeen	0		0	0	0	0	0	0	0	0	
Sioux Falls	0		0	36	0	0	0	0	0	0	8
Nebraska:											
Omaha	1		0	74	12	10	0	1	0	16	60
Kansas:											
Topeka	0		0	0	5	8	0	1	0	5	28
Wichita	1		0	0	2	3	0	0	0	12	24
Delaware:											
Wilmington	0		0	15	7	7	0	1	0	3	37
Maryland:											
Baltimore	2	6	3	25	23	43	0	9	0	155	242
Cumberland	2		1	4	0	0	0	0	0	0	14
Frederick	0		0	0	0	0	0	0	0	0	5
District of Columbia:											
Washington	11	5	2	156	16	18	0	14	0	23	179
Virginia:											
Lynchburg	0		0	0	2	2	0	1	0	0	15
Richmond	0	1	1	2	4	9	0	4	0	1	60
Roanoke	0		0	1	1	3	0	2	0	1	21
West Virginia:											
Charleston	2		0	0	2	0	0	0	0	0	22
Huntington	0		0	1	0	6	1	0	0	0	
Wheeling	0		0	0	4	6	0	1	0	15	21
North Carolina:											
Raleigh	0		0	7	1	3	0	0	0	1	12
Wilmington	3		0	0	2	0	0	1	0	4	17
Winston-Salem	4		0	216	2	1	0	0	1	0	16
South Carolina:											
Charleston	0	50	1	12	6	1	0	0	0	9	26
Columbia											
Greenville	0		0	0	3	0	0	0	0	0	17
Georgia:											
Atlanta	7	34	3	102	15	2	0	4	0	5	100
Brunswick	0	1	1	46	0	0	0	0	0	3	3
Savannah	1	26	3	56	2	1	0	2	0	1	37
Florida:											
Miami	6	2	0	0	3	3	0	1	1	1	30
Tampa	3	4	4	1	4	1	0	1	0	0	30
Kentucky:											
Ashland	0			0		0	0		0	0	
Lexington	5		0	0	2	1	0	2	0	8	18
Louisville	6	1	0	0	15	33	0	3	0	18	76
Tennessee:											
Memphis	1		1	118	19	8	0	5	1	14	106
Nashville	0		3	110	4	9	0	5	1	6	51
Alabama:											
Birmingham	4	5	3	4	5	4	0	7	0	11	82
Mobile	1		1	6	1	0	0	3	0	0	33
Montgomery	2			1		0	0		0	4	

City reports for week ended Jan. 27, 1934—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								
Arkansas:											
Fort Smith	0			27		0	0		0	0	
Little Rock	0		0	28	6	2	1	1	0	0	7
Louisiana:											
New Orleans	17	6	7	10	12	22	0	13	3	0	169
Shreveport	0		0	1	4	5	0	1	0	2	40
Oklahoma:											
Tulsa	2			8		1	0		0	0	
Texas:											
Dallas	13		0	0	7	8	0	2	4	5	62
Fort Worth	5		0	0	3	8	0	0	1	2	36
Galveston	3		0	0	2	3	0	1	0	0	13
Houston	15		0	1	9	4	0	2	0	0	74
San Antonio	3		4	1	10	13	0	5	0	0	68
Montana:											
Billings	0		0	0	0	0	0	0	0	0	6
Great Falls	0		0	2	1	0	0	1	0	0	10
Helena	0		0	0	0	0	0	0	0	0	3
Missoula	0	1	1	0	0	2	0	0	0	0	3
Idaho:											
Boise	0		0	0	0	0	0	1	0	0	12
Colorado:											
Denver	2	17	0	3	10	12	1	7	0	60	87
New Mexico:											
Albuquerque	0		0	1	3	2	0	4	1	2	11
Utah:											
Salt Lake City	0		1	631	4	9	0	1	0	37	43
Nevada:											
Reno	0		0	0	0	2	0	0	0	0	1
Washington:											
Seattle	0		3	3	6	15	0	2	1	78	92
Spokane	0			315	1	4	1		0	8	32
Tacoma	0		0	0	7	0	0	0	0	21	34
Oregon:											
Portland	0	1	0	5	5	19	0	0	0	1	55
Salem	0		0	1	0	0	0	0	0	2	
California:											
Los Angeles	16	20	1	17	23	88	0	28	2	52	308
Sacramento	0		1	0	2	5	0	1	0	4	21
San Francisco	2	3	1	9	10	18	0	15	0	25	185

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Missouri:			
Boston	0	0	1	Kansas City	1	0	0
New York:				Maryland:			
New York	1	1	0	Baltimore	1	0	0
Pennsylvania:				West Virginia:			
Philadelphia	2	2	0	Wheeling	0	0	1
Ohio:				Georgia:			
Cleveland	0	1	0	Atlanta	1	1	0
Indiana:				Tennessee:			
South Bend	2	1	0	Memphis	1	2	0
Illinois:				California:			
Chicago	9	3	0	Los Angeles	2	1	1
Wisconsin:				Sacramento	0	0	1
Milwaukee	0	0	1				

Lethargic encephalitis.—Cases: Boston, 2; Philadelphia, 1; Pittsburgh, 1; Toledo, 1; Detroit, 1; St. Louis, 1; Washington, 1; Sacramento, 2.

Pellagra.—Cases: Washington, 1; Raleigh, 2; Charleston, S.C., 1; Atlanta, 3; Savannah, 3; Memphis, 2; New Orleans, 1; Los Angeles, 1.

Typhus fever.—Cases: Savannah, 2; Tampa, 1. Deaths: Savannah, 1.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended January 13, 1934.—During the 2 weeks ended January 13, 1934, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada, for seven Provinces, as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Alberta	British Columbia	Total
Chicken pox		9		401	569	26	135	1,140
Diphtheria		8	3	43	7			61
Erysipelas				13	3	1		17
Influenza		14		6	15		54	89
Measles		25		60	66	6	4	161
Mumps					233	1	146	380
Paratyphoid fever					1			1
Pneumonia		3			37		30	70
Poliomyelitis					1			1
Scarlet fever		19	4	155	234	8	135	555
Trachoma							1	1
Tuberculosis	2	2	12	103	50	5	22	196
Typhoid fever			13	26	19		1	59
Undulant fever					3			3
Whooping cough		42	1	173	125	3	19	363

NOTE.—No reports were received from Manitoba and Saskatchewan for the above period.

Quebec Province—Communicable diseases—2 weeks ended January 27, 1934.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the 2 weeks ended January 27, 1934, as follows:

Disease	Cases	Disease	Cases
Chicken pox	397	Poliomyelitis	1
Diphtheria	36	Puerperal septicemia	2
Erysipelas	15	Scarlet fever	179
German measles	12	Tuberculosis	121
Influenza	13	Typhoid fever	31
Measles	39	Undulant fever	2
Ophthalmia neonatorum	2	Whooping cough	372

CUBA

Habana—Communicable diseases—4 weeks ended January 27, 1934.—During the 4 weeks ended January 27, 1934, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	4		Tuberculosis	17	
Malaria	7	1	Typhoid fever	2	2

PANAMA CANAL ZONE

Communicable diseases—October–December 1933.—During the months of October, November, and December 1933, certain communicable diseases were reported in the Panama Canal Zone and terminal cities, as follows:

Disease	October		November		December	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chicken pox	6		10		21	
Diphtheria	13		6		10	1
Dysentery (amœbic)	27	2	43	1	58	3
Dysentery (bacillary)					1	1
Leprosy			1			
Lethargic encephalitis			1			
Malaria	142	6	87	2	101	3
Measles	14		7		9	
Meningococcus meningitis			1	1		
Pneumonia		11		26		29
Poliomyelitis			3			
Relapsing fever			1			
Trachoma			1			
Tuberculosis		34		27		34
Typhoid fever	2	1	4		3	1
Typhus fever	1					
Whooping cough	6		4		12	

PUERTO RICO

Notifiable diseases—4 weeks ended January 27, 1934.—During the 4 weeks ended January 27, 1934, cases of certain notifiable diseases were reported in the municipalities of Puerto Rico, as follows:

Disease	Cases	Disease	Cases
Chicken pox	12	Paratyphoid fever	1
Diphtheria	34	Ringworm	4
Dysentery	140	Scarlet fever	1
Erysipelas	5	Syphilis	21
Filariasis	3	Tetanus	2
Framboesia	1	Tetanus, infantile	1
Influenza	69	Trachoma	26
Malaria	[1] 19,495	Tuberculosis	501
Measles	45	Typhoid fever	29
Mumps	30	Whooping cough	328
Ophthalmia neonatorum	3		

[1] Includes results from a special survey.

YUGOSLAVIA

Communicable diseases—December 1933.—During the month of December 1933, certain communicable diseases were reported in Yugoslavia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	34	9	Paratyphoid fever	8	
Cerebrospinal meningitis	4	2	Scarlet fever	505	38
Diphtheria and croup	963	135	Sepsis	10	4
Dysentery	44	8	Tetanus	21	10
Erysipelas	191	8	Typhoid fever	258	35
Measles	701	7	Typhus fever	66	2

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

(NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for Jan. 26, 1934, pp. 128–139. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued Feb. 23, 1934, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Cholera

Philippine Islands.—During the week ended February 3, 1934, cholera was reported in the Philippine Islands as follows: Bohol Province—Antequera, 3 cases, 2 deaths; Balilihan, 2 cases, 1 death; Calape, 1 case, 1 death; Clarin, 3 cases, 3 deaths; Cortes, 4 cases, 4 deaths; Inabanga, 2 cases, 2 deaths; Loon, 2 cases, 1 death; Talibon, 5 cases, 2 deaths; Tubigon, 8 cases, 5 deaths. Cebu Province—Cebu City, 1 case, 1 death. Oriental Negros Province—Ayuquitan, 2 cases, 2 deaths; Bais, 4 cases, 2 deaths; Tanjay, 7 cases, 6 deaths.

Smallpox

China—Manchuria.—A report dated February 3, 1934, states that 300 cases of smallpox with 100 deaths have occurred in Dairen, Manchuria since November 1933, and at the time of the report there were about 100 cases of smallpox. Local authorities are endeavoring to enforce compulsory vaccination.

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