Report of the Poliomyelitis Committee of the Medical Association of the District of Columbia : epidemic 1910.

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REPORT OF THE POLIOMYELITIS COMMITTEE

OF THE

MEDICAL ASSOCIATION

OF THE

DISTRICT OF COLUMBIA

EPIDEMIC 1910

REPRINTED FROM
WASHINGTON MEDICAL ANNALS, VOL. X, NO. 2
MAY, 1911.

ACUTE ANTERIOR POLIOMYELITIS IN THE DISTRICT OF COLUMBIA.*

INTRODUCTION.

In the summer of 1910, the increasing alarm which the prevalence of infantile paralysis in the District of Columbia was generally causing, led to the appointment by the President of the Medical Association of the District of Columbia of a committee, the duty of which should be to investigate the prevalence of the disease and any other facts of interest concerning it, and report the same to the Association. The President, Dr. N. P. Barnes, appointed the following committee: Dr. Philip S. Roy, Chairman; Dr. Prentiss Willson, Secretary, and Drs. Geo. N. Acker, J. B. Nichols, B. M. Randolph, Tom A. Williams and Wm. C. Woodward. At the first meeting of the committee the President of the Association was requested to add the following well-known scientific men to the committee as associate members: John F. Anderson, M. D., Director of the Hygienic Laboratory, U. S. Public Health and Marine Hospital Service; Wm. H. Hough, M. D., Clinical Pathologist, Government Hospital for the Insane; Frederick F. Russell, M. D., Major, Medical Corps, U.S.A.; and Wm. A. White, M. D., Superintendent, Government Hospital for the Insane.

The committee wishes to avail itself of this opportunity to express to these gentlemen its appreciation of their courtesy and of the invaluable nature of their work with the committee. It also takes occasion to thank those physicians who, by their coöperation in reporting their cases, made this report possible, and in this connection it feels that a special expression of its appreciation is due the Staff of the Children's Hospital for their painstaking report of a large series of cases.

While, as the committee is thoroughly aware, nothing new has been added along the lines of epidemiology, symptomatology, or treatment, it feels that the work of Drs. Hough and Lafora along pathological lines presents much that is new and of great value and interest. And while the committee was unable to obtain reports on more than 50 per cent. of the cases known to have occurred in Washington and immediately adjacent suburbs, it believes that the proportions and importance of the Washington epidemic of 1910 are such as to make its record and formal report a matter of obvious expedience. In any event the committee believes the report to be of value as an addition to the numerical method in the Science of Medicine.

EPIDEMIOLOGY OF POLIOMYELITIS IN THE DISTRICT OF COLUMBIA.

Number and Distribution of Cases.—The committee received from various sources information of 552 cases, but upon investi-

* A report of a committee of the Medical Association of the District of Columbia, made to the Association April 25, 1911 and ordered to be printed.

gation it was found that 46 of the reports received were duplicates or represented cases outside of the District. The committee was able, however, to obtain reports on only 246 cases and to obtain the dates of onset of only 150 out of the 246. Information was received of 16 deaths during 1910, occurring among cases that developed within the District, but 11 reports relating to these cases did not give the date of death. Five patients died in the District, who were taken sick elsewhere.

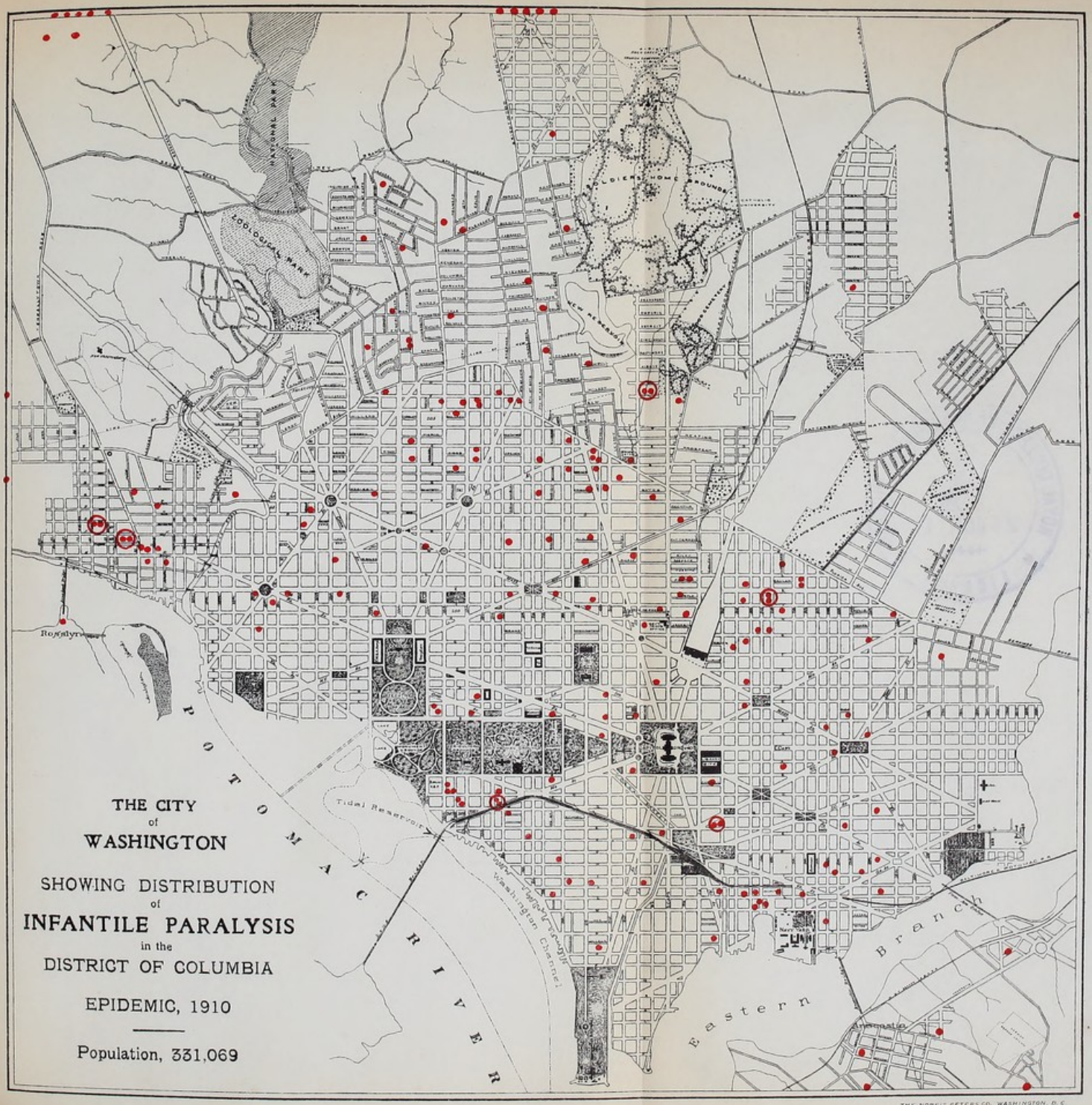
From the data received we were able to spot on the map the location of 188 cases, 176 of these being in the District of Columbia and 12 in the suburbs, either in Maryland or in Virginia, immediately adjacent to the District. The distribution of cases, as spotted on the map, follows closely the density of population and does not seem to bear any definite relation to the sanitary conditions of the locality.

Fatalities.—It is believed that the 506 cases of which we have record include approximately all cases that occurred in the District of Columbia in 1910, and, as previously stated, there occurred among these cases 16 deaths. Computed upon the basis of 506 cases, that being the number of cases shown by the records to have occurred within the District during this period, the case mortality was three per cent. If allowance be made for possible errors of diagnosis, for possible undiscovered duplication of non-fatal cases, and for the possibility that some such cases originated outside of the District, while all the 16 fatal cases occurred among patients who developed the disease within, the percentage of fatalities will, of course, be somewhat increased.

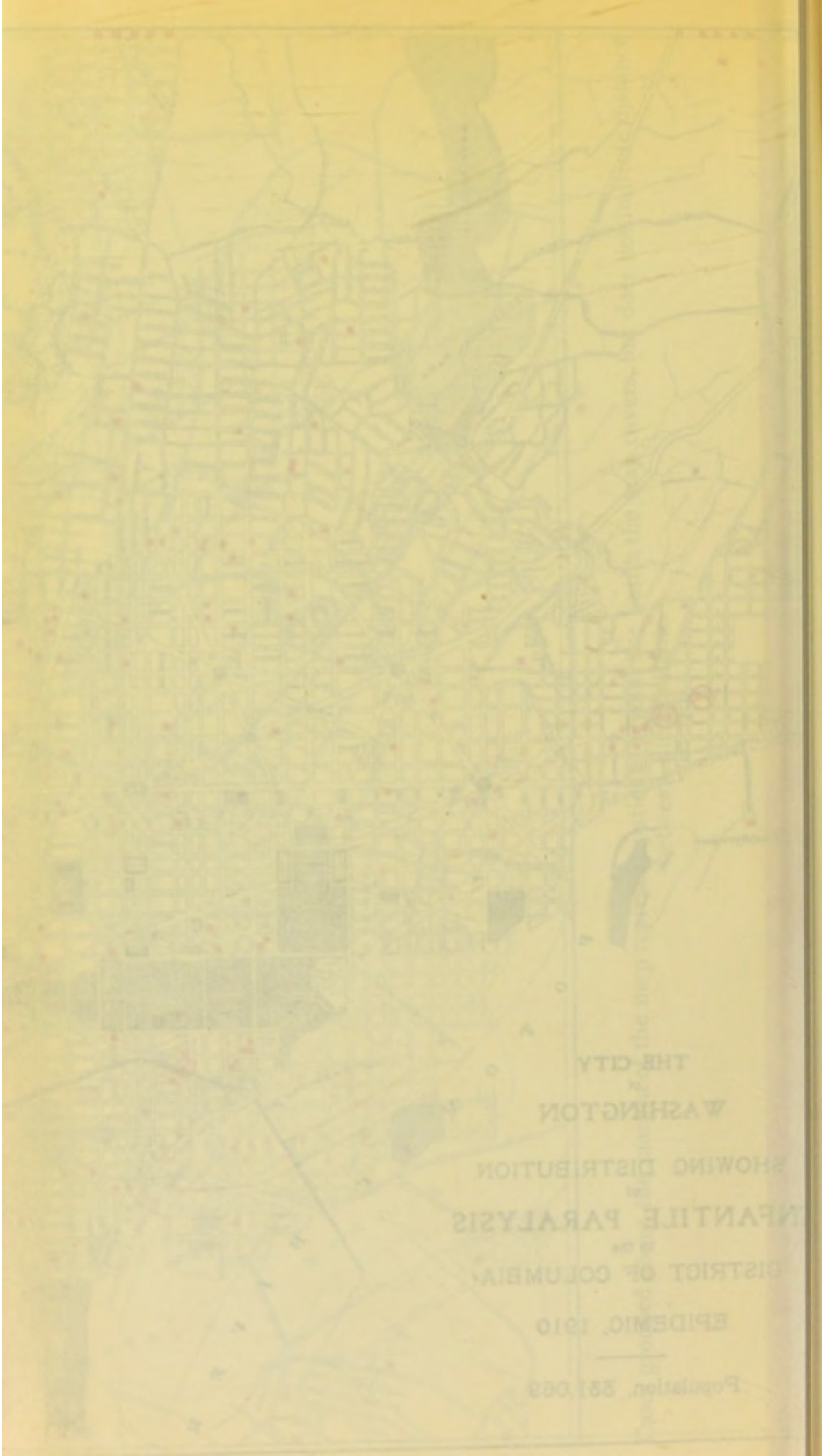
Date of Onset.—The ascertained dates of onset of the 150 cases occurring in 1910 have been plotted on the accompanying curve, by weekly periods. Up to June 1st there were but four cases—one case each in January, March, April and May. The first case in the outbreak began, so far as the reports in the hands of the committee show, on June 7. From that time the number of cases reported week by week gradually increased, so that the curve reached its highest point in the week ending August 9 and then began to fall. The fall was continuous, except for a rise that occurred in the week ending September 6.

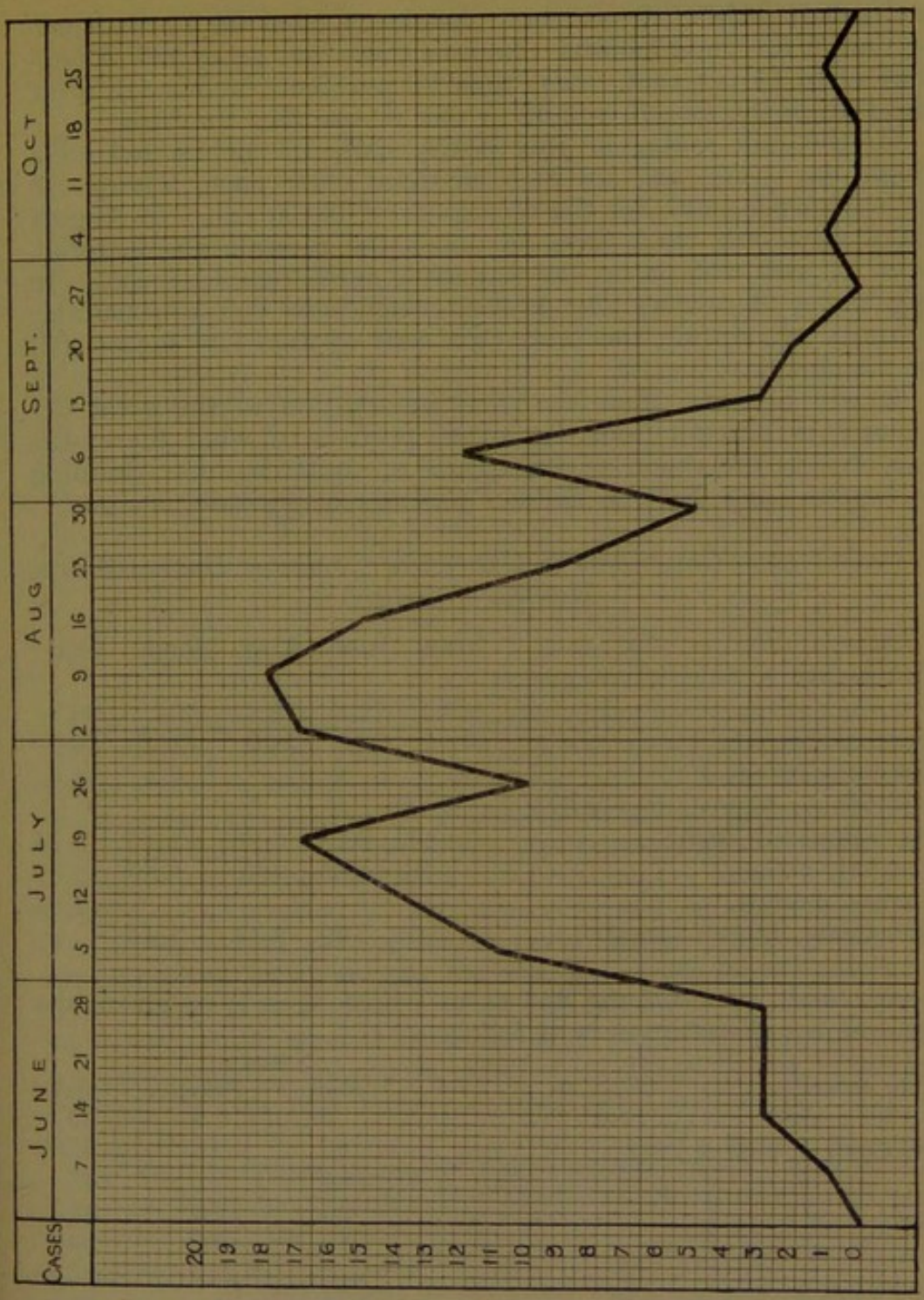
By months, the incidence of cases as determined by dates of onset, was as follows: June, 11 cases; July, 61; August, 54; September, 17; October, 2; and November, 1. It is interesting to note that the outbreak began in June, as did also the New York outbreak of 1907 and the Massachusetts outbreak of 1909. The outbreak in the District, however, seems to have reached its maximum somewhat in advance of the other outbreaks referred to.

There was nothing extraordinary about the temperature during the epidemic, the mean being one degree above the normal mean in July, and about the same degree less than normal in August. June was 3° cooler, and September 3° warmer than the normal



Cases grouped about the margin of the map represent patients beyond the limits the map covers, but does not indicate distance between such patients.





for these months. The mean for the last ten days of June, however, was 77.2, slightly higher than the normal for July, 76.8, and slightly lower than actual mean for that month in 1910, 77.6. The summer weather, therefore, coincided very accurately with the duration of the epidemic.

Rainfall during this epidemic was much less than normal. In July there was nearly one inch, 20 per cent., deficiency; in August, over 3 inches, 71 per cent., deficiency; in September nearly one

and a-half inches, 40 per cent., deficiency from the normal precipitation for these months. In June there was an excess of one-half inch, 14 per cent. Less than 20 per cent. of this fell after the 18th of the month, and all of that on one day, the 27th.

Of the rain falling in July nearly half, 1.5 inches, fell on a single day, 11th, and 1.8 inch on three other days, leaving .43 inch, 11.5 per cent., for the remainder of the month. In August there were only three days on which the rainfall was material, over 1.1 inch, and on no day was there more than 3.1 inches. In September there were four days on which there was a measurable quantity of rainfall, and more than half of this, 1.14 inches, fell on a single day, the 1st.

It will be seen, therefore, that in addition to the great deficiency in precipitation, the larger portion of what there was occurred in the shape of downpours of short duration, draining off rapidly, and that the summer was an exceptionally dry one.

Meteorological Conditions in District of Columbia During Warm Months of 1910.

	June	July	Aug.	Sept.	Oct.
Temperature (mean), degrees F.	69.7	77.6	73.8	71.	60.2
Normal, degrees F	72.7	76.8	74.5	68.1	56.6
Excess, degrees F	...	.8	...	2.9	3.6
Deficiency, degrees F (daily)	3.	...	.7	...	...
Precipitation, inches	4.77	3.73	1.26	2.15	5.74
Normal, inches	4.18	4.65	4.40	3.59	3.09
Excess, inches	.59	...	...	...	2.65
Deficiency, inches (total)	...	.92	3.14	1.44	...

Age and Sex.—Of the 246 cases whose ages were given, the age and sex distribution is as follows:

Age periods.	Sex. Male.	Female.	Total.
Under 1 year	6	9	15
Between 1 and 2 years	29	16	45
2 3	24	21	45
3 4	25	16	41
4 5	19	10	29
Under 5 years	103	72	175
Between 5 and 6 years	9	5	14
6 7	10	5	15
7 8	2	4	6
8 9	5	1	6
9 10	1	0	1
Under 10 years	130	87	217

Age periods.	Sex. Male.	Female.	Total.
10 years old	..	1	1
11	..	2	2
15	..	2	2
16	3	..	3
17	2	..	2
18	2	..	2
19	1	..	1
21	2	..	2
23	1	1	2
25	1	..	1
26	3	..	3
28	2	..	2
31	1	..	1
33	1	..	1
37	1	..	1
38	1	1	2
64	..	1	1
Totals	151	95	246

The youngest patient was 4 months old; the eldest, 64 years.

We see from this that 217 of the 246 cases, equivalent to 88 per cent., were under 10 years of age, and 175, or 71 per cent., were under five years. The greatest number of cases for any annual period occurred between 1 and 2 years, and between 2 and 3 years, each having 45 cases.

Race.—Distribution by race was, white, 209; and colored, 37. The 246 cases of which histories were obtained represent a case rate for whites of 83 per 100,000 and a case rate for the colored of 38.* While these figures are too incomplete to show the actual incidence of the disease in either race, yet they probably show with reasonable accuracy the relative incidence among white and colored, the case rate for the colored being only 46 per cent. of that for the white.

Relation to Other Cases.—In six instances there occurred two cases in the same family (six families). Seventeen cases gave histories of having been exposed to acute cases of poliomyelitis, and one case gave a history of having been exposed to a recovered case. Forty-seven cases gave histories of having been exposed to possible abortive cases of the disease, although the information as to this was not conclusive.

Illness Among Animals.—In one locality, prior to the appearance of anterior poliomyelitis in human beings, there occurred an

* These computations are based upon an estimated population of white, 250,803, colored, 97,657; total, 348,460; the estimates being based upon a series of police censuses preceding the year 1910. The federal census of 1910 reported the total population as 331,069, but it appears that no figures have yet been given out with respect to the race composition.

outbreak of a disease among ducks and chickens associated with paralytic symptoms. A man who performed an autopsy on two ducks having this disease, shortly afterwards developed poliomyelitis; and had it not been for careful laboratory investigations made of the disease, as it occurred in some of the affected ducks and chickens, it might be supposed that there was some relation between the making of this autopsy and the incidence of poliomyelitis. Most painstaking investigations, however, made in the Hygienic Laboratory of the Public Health and Marine Hospital Service, failed to show any relation between the disease as it prevailed in ducks and chickens and poliomyelitis as it occurred in human beings.

Reports were made showing that 7 cases occurred, each in a household in which a dog was also sick; 7 in households in each of which a cat was sick, and 9 in households in each of which chickens were sick.

Conclusions.—It is greatly to be regretted that the committee was not able to obtain data from a larger number of cases, and particularly regretted that the date of onset was obtained in only 150 out of the total of 246 cases reported. The committee's work does not seem to add anything new to our knowledge of the epidemiology of poliomyelitis and offers only two points of possible interest: (1) The distribution of the cases was general, throughout the city, with but little, if any, reference to the sanitary conditions; (2) the date of onset shows that the epidemic apparently reached its maximum in July, and began to decline after the first week in August.

Recommendations.—Your committee recommends, with a view to furthering a study of this disease and of facilitating the restriction of its prevalence, as follows: (1) That the reporting of all cases be made compulsory; (2) that the proper isolation of patients suffering from the disease be required by law; (3) that children residing in dwellings or in families in which cases of poliomyelitis are under treatment be excluded from schools and other places of public assemblage.

HISTOPATHOLOGICAL REPORT OF A CASE OF POLIOMYELITIS ANTERIOR EPIDEMICA.

By Dr. Gonzalo R. Lafora,

Histopathologist in the Government Hospital for the Insane,

Washington, D. C.

Macroscopical Examination.—The gross examination of the spinal cord showed a slight dilatation of the vessels and a thickening of the pia. The gray matter appeared reddish, with small hemorrhages visible to the naked eye, and very clearly delimited

from the white matter. The anterior horns were the most affected in this process, although in the lumbar segment the lesions also extended to the anterior part of the posterior horns. The cervical and lumbar enlargements were decidedly much more affected than the other parts of the cord. The conus medullaris showed very slight lesions. In the pons and in the medulla oblongata dilatation of the vessels and small hemorrhages were seen. As a whole the lesions in the right side were more marked.

Microscopical Examination.—The findings in my case agreed to a great extent with those mentioned by previous observers. In the description I shall pay more attention to some facts not previously described, which I was able to detect, knowledge of which is necessary in order to prevent further errors in the interpretation of the lesions in this disease.

Infiltration of the vessels with lymphocytes and plasma cells, the disappearance of the ganglion cells in certain portions of the spinal cord, or their degeneration in the anterior horns, were confirmed in my case. The production of a large number of Körnchen-cells filling the gray matter and surrounding the few remaining ganglion cells was also a striking feature.

I could not find any difference in the quantity of infiltration in the arteries and veins, a condition which Wichmann, Tharbitz Shell and Strauss have described.

The plasma cells are also found outside of the adventitial spaces of the vessels and many showed karyokinetic processes or possessed two or more nuclei (see drawings).

Most of the macrophages, which sometimes fill the entire anterior horn, were of the mononuclear variety. Many Körnchen cells were also found. A fact not mentioned by other investigators was the presence of Stäbchen cells of neuroglial origin. These were found, quite often, and Mast cells, although seen, were very few.

Among the great number of cells, which infiltrated the gray matter, at times very small diplococci were seen. I also observed some formations, without nuclei, but in the interior of which numerous bodies were contained. These bodies assumed different forms, but were never spherular, like those described in a case by Proescher.* Morphologically they remind us a great deal of the encapsulated forms of the Leishman-Donovan bodies in Kala-Azar. (Figs. 19 and 20.)

I found many homogeneous, round or oval bodies which stained very deeply with pyronin, while the chromatin of the cell nuclei took the methyl-green in the Unna-Pappenheim method. Many other degenerated parts of nuclei stained green with this method, as is shown in the drawings.

The significance of the round bodies is doubtful, although it is

* *New York Med. Jour.*, Nov., 1910.

possible that they are rests of nuclei which have been chemically transformed, and which consequently take pyronin instead of methyl-green.

Many other formations of variable disposition were found in the lymphatic spaces between the nerve fibers of the white matter. These bodies were very likely rests of lymphocytes and leucocytes degenerated and transported by the lymphatic stream.

Besides the degenerations in the ganglion cells described by previous observers, mention should be made of the striking hypertrophy of the nucleolus. From the studies of Levi, it is well known that the nucleolus of the ganglion cell contains a central part which is acidophile and therefore stains red by the triacid method and another peripheral part which is basophile and stains green by this method. The basophile elements appear under the form of smaller bodies around the acidophile and they are also called perinucleoli. In these two parts of the nucleolus a hypertrophy has been described by Achúcarro in rabies. It consisted in the multiplication either of the acidophile or basophile part which lead to the production of series of spherules staining red or green. This phenomenon has been latterly described by Lertz. Since his description this formation has received the name of Lertz bodies.* I found them in a large number of ganglion cells which appeared to be not very greatly degenerated (see Figs. 1 to 4).

In many other ganglion cells very marked neuronophagy was observed. Some of the satellites penetrated the protoplasm of the ganglion cells, giving rise to pictures very similar to Negri bodies, but they differ very much from the latter.

The Altmann granules of the ganglion cells also appear to be greatly increased in number, a condition previously described in rabies.

Explanation of Plate I.

Figs. 1 to 4. Ganglion cells from the anterior and posterior horns of the spinal cord showing hypertrophy and multiplication of the acidophile part of the nucleolus.

Fig. 5. Penetration of neuroglia satellite cells into the photoplasm of the ganglion cells, giving rise to pictures similar to those of the Negri bodies in rabies.

Fig. 6. Rod-like cells (Stäbchenzellen), of the spinal cord (from the part between the gray and white matter).

Fig. 7. Five plasma cells, one in karyokinesis, from the interstitial tissue of the anterior horns.

Fig. 8. Two reticulated cells of endothelial origin acting as scavenger cells.

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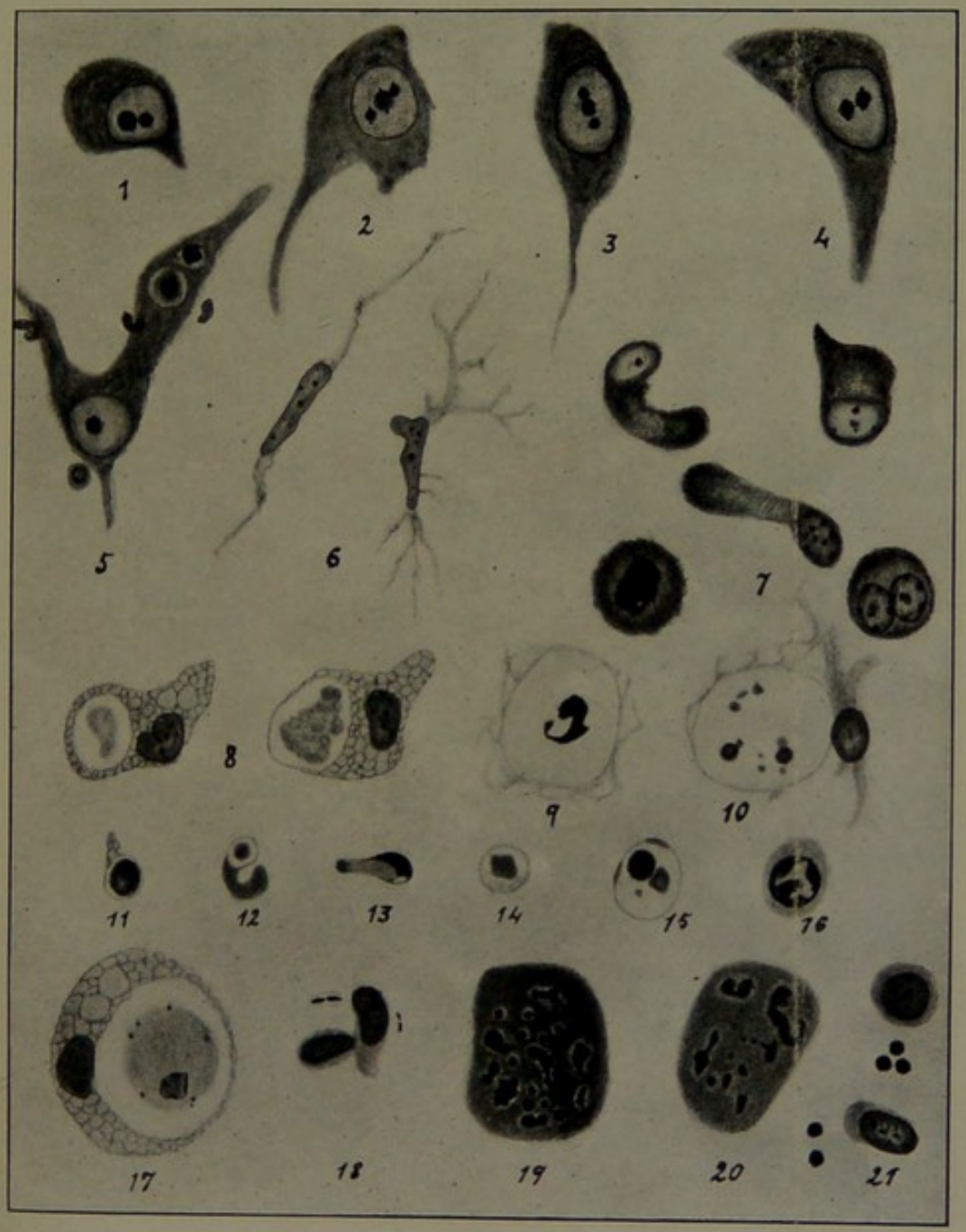
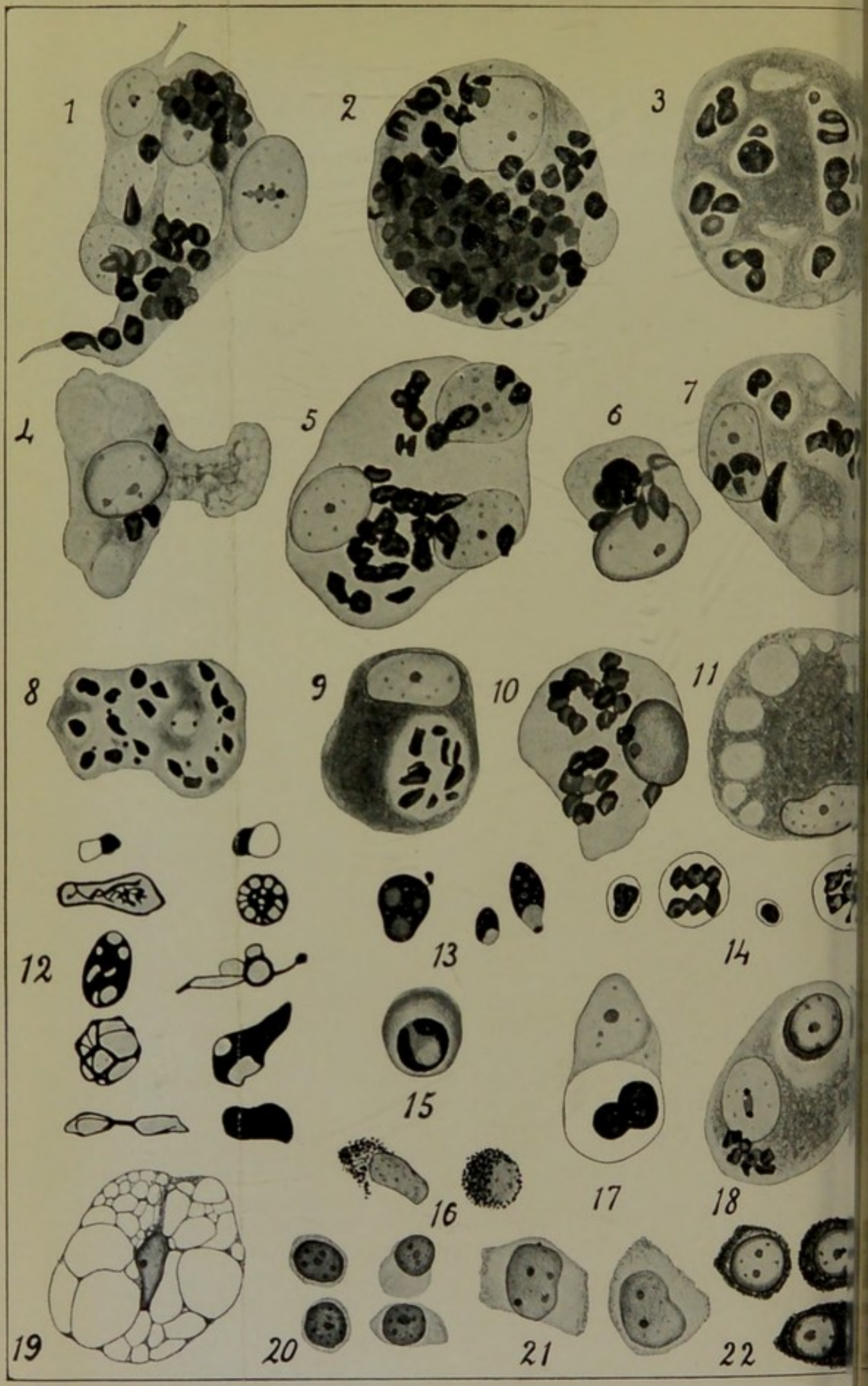
* Recently they have been also found in sporotrychosis of the brain. They seem to be an irritative phenomenon, which appears usually only in the protozoan diseases.



Lafora, pinx.

Plate I.



Lafora, pinx.

Plate II.

Fig. 9. Lymphatic space of the white matter of the spinal cord containing the rest of a cell nucleus.

Fig. 10. Lymphatic space of the white matter containing rests of cells.

Figs. 11 to 16. Formations derived from degenerated cells, found in the lymphatic spaces of the white matter between the nerve fibers.

Fig. 17. Large macrophage containing a body, probably a rest of a degenerated cell.

Fig. 18. Diplococcus found in the necrotic zone of the gray substance.

Figs. 19 and 20. Large formation (size three or four times larger than a neuroglia cell) found in the infiltrated gray matter of the spinal cord; containing a number of polymorphic bodies of unknown origin.

Fig. 21. Small round bodies, showing pyroniniphile reaction, found in the infiltrated zone of the gray matter (compare their size with that of the neuroglia cells). They are also probably the detritus of cells, showing changes in their histochemical composition.

Description of Plate II.

All drawings with the exception of No. 8, which is taken from Mott (magnification 1,000 diameters) are drawn with the 1/12 oil imm. Zeiss and No. 12 comp. ocular.

Fig. 1. Macrophage of the spinal fluid with many bodies (see description in text) probably rests of nuclei of the polymorphonuclear leucocytes. The nuclei of the macrophage are nuclei of mononuclear cells (large lymphocytes). Regressive modification of the nucleolus in the nucleus on right side. (Toluidin blue.)

Fig. 2. Macrophage with endothelial nuclei and an enormous number of degenerated nuclei (no vacuoles). (Toluidin blue.)

Fig. 3. Macrophage with several vacuoles in which are contained some rests of degenerated nuclei, some of which (drawn with light shade) show the "fuchsinophile reaction" with the Ehrlich triacid methods. No trace of the nuclei of the macrophage. (Ehrlich's triacid.)

Fig. 4. Macrophage of mononuclear origin with three degenerated rests of nuclei. (Unna—Pappenheim.)

Fig. 5. Macrophage with three nuclei of endothelial origin and many bodies. (Unna—Pappenheim.)

Fig. 6. Little macrophage of mononuclear origin with some "pyroninophile" bodies (drawn clear) stained red and several other bodies stained green with methyl green. (Unna—Pappenheim.)

Fig. 7. Large macrophage with vacuoles which contain some degenerated nuclei. (Ehrlich's triacid.)

Fig. 8. Leishman—Donovan bodies from the blood of the spleen

of a case affected with Kala-Azar. Note the similarity with the bodies found in Jinga trypanosomiasis and with the other bodies illustrated here. (The drawing is taken from Mott.)
Fig. 9. Macrophage of mononuclear origin with a large vacuole full of degenerated rests of nuclei. (Ehrlich's triacid.)
Fig. 10. Macrophage with nuclei and rests of polymorphonuclear leucocytes. (Tuluidin.)
Fig. 11. A vacuolated macrophage of endothelial origin without inclusions. (Unna—Pappenheim.)
Fig. 12. Altered red blood cells with unusual forms, the dark parts are stained red and the gray are stained green or are unstained. (Ehrlich's triacid.)
Fig. 13. Greatly degenerated nuclei of lymphocytes. (Toluidin.)
Fig. 14. Degenerations and rests of polymorphonuclear leucocytes, the latter with pyroninophile reaction and not included in macrophages. (Unna—Pappenheim.)
Fig. 15. Mononuclear cell (large lymphocyte with degenerated nuclei) accumulation of the chromatin in the periphery of the nuclei (Kernwandhyperchromatosis). (Toluidin.)
Fig. 16. Two mast cells. (Toluidin.)
Fig. 17. Macrophage probably of endothelial origin with rests of two degenerated nuclei (lymphocytes?). (Toluidin.)
Fig. 18. Macrophage of mononuclear origin with lymphocyte contained in a vacuole and rests of degenerated nuclei in the protoplasm. (Toluidin.)
Fig. 19. Gitter cell of endothelial origin. (Unna—Pappenheim.)
Fig. 20. Four lymphocytes of normal appearance. (Toluidin.)
Fig. 21. Two large lymphocytes (mononuclear cells) with a little metachromatic protoplasm. (Toluidin.)
Fig. 22. Three plasmacells. (Toluidin.)

SOME FINDINGS IN THE CEREBROSPINAL FLUID IN ELEVEN CASES OF ACUTE ANTERIOR POLIOMYELITIS—EPIDEMIC FORM.

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and
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Histopathologist, Government Hospital for the Insane,
Washington, D. C.

(A preliminary report.)

From the study of the literature[1] on poliomyelitis it appears that in the early stages of the disease there is frequently found a moderate degree of hypertension of the fluid and an increase of protein content and cellular elements. At first the percentage of polymorphonuclear leucocytes is high and later in the disease the

[1] For detailed account on this subject see our article in *Folia Neuro-Biologica*, Bd. V, No. 3, 1911.

lymphocytes are in excess. The pleocytosis disappears rapidly so that shortly after the subsidence of the fever the fluid may be nearly cell free. It should be remembered, however, that most of the authors whose results we have summarized, have failed to give satisfactory indications of their methods and do not describe their findings with as much care as should be used in their work. On account of the variations in the individual reports and the fact that a preliminary study of one case showed certain elements not previously described, the attempt was made to examine carefully a number of fluids from various points of view and with the most exact methods.

The following methods were employed in our studies: The globulin content was roughly estimated by the Noguchi butyric acid reaction. The Fuchs-Rosenthal method was used for the quantitative cell estimation and the Alzheimer[1] method for the qualitative study of the cellular elements. The French method was used in a few cases for comparison. The stains used were toluidin blue, Ehrlich's triacid mixture, Unna-Pappenheim pyronin-methyl green, Giemsa, Romanowsky, hematoxylin-eosin and Heidenhain. We consider it essential for a detailed study of the cells of the fluid to employ many different methods of staining, especially where there is such a multiplicity of morphological elements as is found in the disease under consideration. As will be shown presently, we have frequently observed that certain important details are brought out by one staining method which are not shown by others.

It is to be seen from the table that lymphocytes were in excess in all the cases examined and that the highest percentages of polymorphonuclear leucocytes were found in the early cases. Plasma cells, Körnchenzellen and macrophages were found in all cases in which there was a pleocytosis and several mast cells were found in cases number 1 and 2.

The preceding description of the presence in the fluid in the earlier stages of the disease of many polymorphonuclear leucocytes, which disappear very rapidly after some days, indicates that there takes place in the fluid an acute process of reentrance of the polymorphonuclear leucocytes into the blood or lymph, and that this process can only be understood as the effect of a phagocytosis on the part of the macrophages, or as an autoselective disintegration of these leucocytes with subsequent reabsorption through the lymphatic stream. In the three cases in which we studied the spinal fluid in the first days of the disease, we found indications that the first supposed process is the one that takes place. We observed in all these cases, especially case 2 (a case

[1] The technique and results obtained by this method with colored plates of the various elements found in a number of nervous diseases have been published by one of us. Hough, W. H.: Government Hospital for the Insane, Bulletin No. 1, 1909, pp. 89–106; Bulletin No. 2, 1910, pp. 118–135, Washington, D. C.

FINDINGS IN THE CEREBROSPINAL FLUID IN ACUTE ANTERIOR POLIOMYELITIS.

Number.	Name.	Age.	Duration of disease at time of puncture.	DIFFERENTIAL COUNT.[2]									Noguchi butyric acid reaction.	Remarks.
				Cells per cu.m.m.[1]	Lymphocytes.	Large mononuclear cells.	Polymorphonuclear leucocytes.	Plasma cells.	Körnchenzellen.	Macrophages.	Endothelial cells.	Fibroblasts, degenerated, & unclassified.		
					Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.		
1	H. C.	16 mo.	3 days.	90	66	3	18	9	.25	.25	.50	3	++	
2	M. H.	25 yrs.	4 "	[3]	80	2	14	.75	.50	1	1.25	.50	++	60 to 100 cells per oil im. field.
3	E. G.	19 yrs.	6 "	64	93	.75	4.50	.25	.25	.25	.50	.50	++	
4	A. P.	11 mo.	10 "	14	69	18	3.50	5	3	.25	.25	1	++	
5	T. J.	14 yrs.	12 " ?	6	67	31	.50				.50	1	++	
6	C. H.	3 yrs.	7 " ?	6.5	88	7.5	.25	2.50	.75	.25		.75	++	
7	C. C.	2 yrs.	14 "	5	80	12	1.50		.50	.25	.25	5.50	+	
8	E. W.	1 yr.	21 "	9	78	12	2	4				4	+	
9	R. N.	2 yrs.	25 "	56	84	9	1.75	.50	.75	.25	.25	3.5	++	Slight blood contamination.
10	E. C.	2 yrs.	35 "	5	88	12							— —	
11	B. B.	2 yrs.	17 "	96	64	21	3	.50	.50	1	3.50	6.50	++	Specimen taken 12 hrs. Post Mortem.

[1]Estimated by Fuchs-Rosenthal method. [2]Estimated by Alzheimer method. [3]The coagulum in this case was furnished us by Dr. Tom A. Williams and we were unable to estimate the number of cells per cu.m.m.

manifesting pronounced toxic symptoms) that the spinal fluid contained a great number of large macrophages, some of endothelial origin, whose protoplasm was full of vacuoles containing particles of chromatin with very diverse aspects and morphology Figs. 1, 2, 3, 4, 5, 6, 7, 9, 10, 17 and 18 of plate II). In some of the cells these particles remind us morphologically of bodies which have been described in many protozoan diseases: for example, the Leishman—Donovan bodies in smear preparations of the blood in Kala-azar, or the bodies found by Mott around the vessels in the brain of oxen infected with Jinga trypanosomiasis, are in many respects similar to the bodies found in the protoplasm of the macrophages.

In our investigations many of the bodies above mentioned take a red color (pyronino phile), while others show a very constant green color; this is especially interesting because of the fact that many of the macrophages besides having an accumulation of such bodies in a pole of the protoplasm, have also a vacuole in which is contained a polymorphonuclear leucocyte, the nuclei of which, are stained a bright green color. These histochemical changes may explain the rapid disappearance of the leucocytes from the spinal fluid through rapid process of disintegration of the degenerated polymorphonuclear leucocytes which are inclosed in the macrophages and which undergo rapid histochemical changes probably produced by a digestive process. From these last facts it is difficult to say whether the macrophages are attracted by positive chemiotaxis to the degenerated leucocytes and that they are constantly embracing individual ones or whether there is a preceding process of clumping (agglutination?) of the leucocytes after they have accomplished their defensive activities and then followed by inclusion "en masse" by the macrophages.

We have also found in the spinal fluid isolated corpuscles surrounded by a small amount of protoplasm (see fig. 14). We believe that these bodies are only rests of degenerated leucocytes and perhaps also sometimes lymphocytes embraced by macrophages in their phagocytic activity. In favor of this supposition may be mentioned the fact that we have observed all of the intermediate stages of the degenerative and histochemic differentiation. We have therefore no basis for assuming that these bodies are of a parasitic nature.

The rests of the nuclei, both in the nervous system and in the lymphatic and blood circulation, may have extraneous appearances which should not be considered to be a parasitic formation. Notwithstanding these facts, the presence of a great number of plasma cells and lymphocytes and of several mast cells in the spinal fluid as well as the histopathology of the lesion in the spinal cord incline us to admit the possibility of the protozoan origin of anterior poliomyelitis.

The short reactive process of the polymorphonuclears is, how-

ever, a fact contradictory to this supposed origin. This short polymorphonuclear period may be considered as the meningeal reaction to the penetration of the virus into the nervous system.

From the distribution of the histopathological picture in poliomyelitis and also from the comparison with similar pathological lesions in other diseases of non-bacterial origin, e.g., trypanosomiasis, echinococcus, blastomicosis, sporotrichosis of the nervous tissue and probably rabies, it seems not unlikely that the organism producing the disease is a parasite (probably a protozoan) and that the way of entrance is through the vascular system.[1]

We observed also small altered erythrocytes appearing variously stained, and degenerated lymphocytic nuclei which were found very often in the spinal fluid in this disease.

The other elements found in the fluid do not merit special description; they are lymphocytes in their various forms; small and medium size plasma cells usually with a single nucleus, rarely in a karyokinetic process; occasionally mast cells of a very small size; mononuclear cells belonging to the large lymphocyte group and to the transition forms of Ehrlich; Körnchenzellen with round, oval or compressed nuclei, the framework of which appears splendidly stained by the triacid method, and finally several endothelial cells (many of them having vacuolated protoplasm) indicating a progressive or regressive character. A separate description of them will be found in the article by one of us previously referred to[2]).

Conclusions.

1. The cerebrospinal fluid in acute anterior poliomyelitis is generally clear; there is in the early stages of the disease an increase of pressure although this is not generally pronounced and there is usually an increase of the protein content sufficient to give a positive Nonne–Alpelt and Noguchi butyric acid reaction.

2. In the earlier stages of the disease there is more or less pleocytosis in the spinal fluid. There are many polymorphonuclear leucocytes which are probably dependent upon the reaction of the meninges to the penetration of the virus into the central nervous system.

3. The increase of polymorphonuclears disappears a few days after the acute onset of the disease and is substituted by a lymphocytosis with some plasma cells and sometimes a few mast cells.

4. The disappearance of the polymorphonuclears is brought about through the rapid and vigorous phagocytic activity of the macrophages which sometimes contain twenty or more rests of the polynuclear elements.

5. These degenerated polymorphonuclear leucocytes show in the framework of the macrophages very different degrees of histo-

[1] We bear in mind, however, the fact that some chronic bacterial diseases of the nervous system, as tuberculosis, present a somewhat similar pathological picture.

[2] Op. Cit.

chemical changes which are indications of rapid processes of digestion.

6. The presence of the altered red blood cells in the spinal fluid is probably dependent upon capillary hemorrhages in the spinal cord which is a consequence of the selective preference of the disease for the spinal vessels.

7. Körnchenzellen, altered lymphocytes and other mononuclear elements are commonly present in the fluid until after the fever period.

8. In our histological study of the spinal fluid in the disease, we did not observe any stained bacteria.

9. The similarity of the histopathology of the spinal fluid in poliomyelitis to that of the fluid in some protozoan diseases affecting the nervous system is argument in favor of the protozoan nature of the virus in poliomyelitis, even though some other investigators claim the disease to be produced by a much smaller organism.

THE SYMPTOMATOLOGY AND TREATMENT OF THE EPIDEMIC ANTERIOR POLIOMYELITIS ACUTA, WHICH OCCURRED IN WASHINGTON IN 1910.

When the investigation of the Washington epidemic was decided upon, one of the hopes of your committee was that a more precise knowledge of the early symptoms of acute anterior poliomyelitis would be gained. This hope appeared reasonable; for the means seemed to be provided for a concerted inquiry during the prodromal stage in many cases. This hope has not been realized, due to many physicians finding it impossible for them to furnish complete reports and others feeling that their data were too meagre to send to the Committee.

The following figures are collected from an analysis of all cases presented to the committee. Some of the cases reported are incomplete, and there is frequent failure to differentiate between prodromal symptoms, symptoms of onset, and symptoms occurring in the course of the disease. In such instances the committee has had to use its judgment in grouping the symptoms in accordance with probability, or in throwing them out altogether. No symptom has been classed as prodromal, except when placed under this head by the reporting physician. It would appear that in some cases the differentiation between prodromes and symptoms of onset has not been clearly made, even when so classified by the reporter. These observations must be taken into consideration in estimating the value of the accompanying figures.

The Invasion and Fastigium.

Prodromes.—In the majority of cases it appears that the prodromal period lasts from a few hours to several days. In 27 cases prodromes are stated to have been absent. Those occurring

most frequently are irritability, 100; restlessness, 69; apathy, 50; with a marked tendency to various digestive disturbances, though the latter are by no means constant. Pain as a prodrome is not frequent and seems to be more generalized than local. Catarrhal conditions of the respiratory mucous membranes are conspicuous by their absence.

Duration of Prodromes.—1 hour, 2; 18 hours, 2; several hours, 1; 1 day, 12; 2 days, 9; 3 days, 8; 4 days, 12; 5 days, 2; 6 days, 1; several (or a few) days, 39; 1 week, 11; 2 weeks, 7; 3 weeks, 2; 4 weeks, 1.

Prodromes.—Fever, 27; headache (frontal, 1; occipital, 1), 14; irritability, 100; restlessness, 69; apathy, 50; muscular twitching, 19; sweating, 14. Pain—neck, 2; back, 4; muscular, 3; abdomen, 2; feet, 1; extremities, 2; joints, 1; unspecified, 1—16. Constipation, 15; diarrhoea, 6; nausea, 5; vomiting, 10; anorexia, 6; coated tongue, 2; foul breath, 1; gastric indigestion, 1; intestinal indigestion, 2; gastro-enteritis, 1; tympanites, 1; unspecified, 5; malaise (including indisposition and languor), 9; sleepiness, 2; vertigo, 1; insomnia, 1; delirium, 1; convulsions, 2; coma, 2; photophobia, 2; stupor, 6; chills (single, 1; multiple, 1; unspecified, 1), 3; scanty urine, 1; weak bladder, 1; general weakness, 4. Prodromes stated to be absent in, 27.

Mode of Onset.—The most constant symptom of onset is fever, 181. Next in order come headache 57, vomiting 78, constipation 32, diarrhoea 23, prostration 35, restlessness 27, malaise 20, apathy 17. Pain is usual 102, especially in the legs 26, and back 29. Less frequent are convulsions 11, delirium 9, loss of consciousness, partial or complete, 18. In 11 cases the onset was characterized by chill. Retraction of the head was not infrequent 21, and muscular rigidity 9, opisthotonos 4, and stiffness of the neck, back or legs 6, were noted.

It is interesting to note that the onset was sudden in a large proportion of cases 47, and that sudden paralysis without any preliminary warning occurred in 13. There is a surprising lack of frequency of associated inflammation of the respiratory mucous membranes and throat 10, especially as this feature was put as a leading question on the blanks sent out by the committee for the report of cases.

Mode of Onset.—Fever, 181; headache, 57; anorexia, 14; nausea, 49; vomiting, 78; diarrhoea, 23; constipation, 32; digestive disturbances, 48; tympanites, 3; abdominal pain, 11; foul stools, 1. Pain—Legs, 26; knees, 2; back, 29; foot, 1; neck, 6; unspecified, 11; joints, 6; general muscular, 21; total, 102. Weakness—Legs, 2; neck, 1; spine, 2; unspecified, 4; total, 9; malaise, 20; irritability or restlessness, 27; insomnia, 4; fatigue, 1; nervousness, 1; drowsiness, 3; apathy, 17; vertigo, 1; tremor, 1; muscular twitching, 5; delirium, 9; convulsions, 11; coma, 6;

stupor, 6; unconsciousness, 6; prostration, 35; hyperaesthesia, 1; chill, 11; sweat, 3; retraction of head, 21; muscular rigidity, 9; opisthotonos, 4. Stiffness—Legs, 1; neck, 4; back, 1; total, 6. Onset sudden, 47; sudden paralysis, 13; collapse, 1; syncope, 1; bradycardia, 1; dyspnoea, 3; cyanosis, 1; dysphagia, 1; nose bleed, 1; puffiness of eyes, 1; contracted pupils, 1; dilated pupils, 1; bronchitis, 4; rhinitis, 3; laryngitis, 1; sore throat, 2; urticaria, 1; retention of urine, 2; bladder weakness, 2.

Duration of Acute Stage.—The duration of the acute symptoms presents the greatest degree of inconstancy, varying from 12 hours to 6 months, with an average of 9.4 days. It is certain that the actual average duration is somewhat shorter than this, and that the excessive duration, 4 weeks to 6 months, applies in some cases to the total period of invalidism rather than to the duration of the acute symptoms. As the average is obtained by dividing the total duration in days of all cases by the number of cases, it will be readily seen that a very few such errors in giving long periods would raise the average very materially, and constitutes a much greater source of error than would an inaccuracy in shorter periods.

Duration of Acute Symptoms.—12 hours, 1; 1 day, 2; 2 days, 12; 3 days, 18; 4 days, 20; 5 days, 17; 6 days, 2; 7 days, 28; 8 days, 3; 9 days, 3; 10 days, 12; 12 days, 1; several days, 4; 2 weeks, 20; 3 weeks, 14; 4 weeks, 3; 5 weeks, 1; several weeks, 2; 1 month, 4; 2 months, 2; 3 months, 1; 6 months, 1.

Fever.—The statistics as to the course and duration of the fever are not definite. It is sometimes high and sometimes moderate, and it is occasionally stated to have been absent. The tendency seems to have the maximum temperature at onset, with a gradual defervescence, lasting several days.

Skin Eruptions.—Skin eruptions are present rather frequently 39, but their form is too varied for them to be considered in any way characteristic. In several cases they are obviously merely coincident. It is probable that they would occur with like frequency in any group of patients of this age with an equal degree of fever and digestive disturbance. Eruptions are stated to be absent in 140 cases, which shows that there is no characteristic lesion of the skin.

Sweating.—Sweating at some stage is common 56, but by no means constant; absent in 120.

Skin Eruptions.—Flea bites, 3; chigger bites, 1; pimples (face), 1; heat-like, 1; erythema, 3; dermatitis, 2; petechial, 1; rose spots, 1; bullae, 1; morbiliform, 2; macular, 1; vesicular, 5; herpetic, 3; urticaria, 1; unspecified, 9; eruptions stated to be present in 39 cases, absent in 140 cases, sweating (excessive) stated to be present in 56 cases, absent in 120 cases.

Summary of First Series of 150 Cases.

Prodromes.—Irritability, 48; muscle twitching, 10; restlessness, 37—total, 95. Apathy, 12; sweating, 10; constipation, 11; fever, 18; headache, 10; prodromes absent, 17.

Duration of Prodromes.—Over a week, 15; a few days, 5; four days or less, 39.

Mode of Onset.—Fever, 79; headache, 13; anorexia, 12; nausea, 11; vomiting, 37; diarrhoea, 13; constipation, 21; irritable or restless, 15; sudden onset, 23; sudden paralysis, 9; pains, 39; stiffness, 5; weakness, 7.

Duration of Acute Symptoms.—5 days or less, 50; 1 week or more, 57.

Eruptions of Skin.—Present in 30, absent in 93 cases.

Sweating (Excessive).—Present in 40, absent in 79 cases.

Circulatory System.—Pulse rate generally increased; seldom mentioned as weak. Extremities hot, 50 per cent.; extremities cold, 50 per cent., after the fever.

Respirations.—Labored in a few cases. Catarrh rarely present.

Digestive System.—Anorexia, 85 per cent.; coated tongue, 85 per cent.; nausea and vomiting, 50 per cent.; diarrhoea, 10 per cent.; constipation in the great majority; stools not significant.

Urine generally normal.

The nausea and vomiting so often found should be regarded as central irritation; and the anorexia and coated tongue are merely part of the toxic syndrome which is also revealed by the fever.

The signs of respiratory catarrh, in search of which the committee was most insistent, are rarely noted; and it is our belief that this epidemic has shown them to be insignificant.

Nor has it appeared that intestinal catarrh may be regarded as a symptom provokable by the virus of poliomyelitis; for diarrhoea was noted in only ten per cent. of the cases, not a large proportion in the midst of hot summer amongst patients, the majority of whom were young children.

The Nervous System.—It has not been possible to separate entirely the symptoms during the different stages of the attack. In the 150 cases which the committee first received, and which were the most carefully compiled, the most conspicuous early symptoms were insomnia, pains in head, neck, back and limbs, tenderness, restlessness and irritability, other definite meningeal irritations, shown either by retraction of head, rigidity of neck or Kernig's sign, stupor and apathy, which latter occurred in about a third of the cases. The details are embodied in the subjoined table.

With regard to the data concerning the reflexes, some qualification is required; for they were completely examined only in a few cases. Thus, proportionate figures cannot be obtained.

Exaggeration of the reflexes is not noted; although the Babinski sign is said to have been present seven times. In estimating this statement, it must be remembered that in the very young child, the toe extends on stroking the sole, and that the defense reaction is easily mistaken for the sign of Babinski if the observer is not on his guard.

As to the paralysis, it was most frequent in the lower limbs, occurring in one or both in nearly every case. The unusual number of cases in which paralysis was noted in neck, back and abdomen requires remark. It is possible that in some cases, rigidity has been termed paralysis; for in only four cases out of twenty-eight is it stated that a paralysis of the neck persisted; but it must not be forgotten that many reports did not comprise the further history of the case.

Nervous System.

Paralyzed parts at first flaccid, 106; rigid, 12. Neck rigid and legs flaccid, 1; stiff in joints, 1.

Delirium, 11. Slight, 4; slight at first, 1; slight 2d week, 1; marked, 1; 1st night, 1, and 4 nights, 1; at first, 1; at night, 1; at times, 2.

Insomnia, 56. Marked, 2; on onset, 1; during acute stage, 1; only on account of pain, 2; slight, 6; sleepy, 1; 2 days before death, 1; short naps night and day, 1; at first, 1; 1st 2 days, 1; did not sleep well, 2.

Pain in head, 50. Frontal, 1; constant, 1; only 1st day, 1; slight, 2; at first, 3; 1st 2 days, 1; back, 2; some, 1.

Neck, 59. At first, 1; at times, 1; stiff, 1.

Back, 65. On movement, 1; at first, 1; much, 1; some, 1; tender, 1; lumbar, 1.

Limbs, 71. Left arm, 1; legs, 1; on movement, 1; right leg, 3; thigh, 1; left leg, 3; legs and thigh, 1; hips, 1; marked, 2.

Elsewhere, 15.

Situation and character of pain. Hip and knee on movement, 1; all over when handled, 1; stomach, 1; right leg, 2; left leg, 3; general, 2; left hip, 2; abdomen, 2; arms and legs, 1; upon movement, 1; back and right leg, 1; head severe and other parts, soreness, 1; in muscles, 1; right arm, 1; all over, 1; severe on motion, 1; intense, 1; sharp, 6; uncertain, 1; dull ache, 1; severe, 1; from distention, 1.

Tenderness, 90. Pronounced, 1; cried when touched, 1; slight, 2; exquisite, 1; not at first, 1.

Situation and character of tenderness, cervical and sacral regions, 1; right leg, 1; insertion of the hamstrings, 1; over entire left limb, 1; lower limbs, 16; calf muscles, 1; calf of left leg, 1; movement of legs, 1; over affected parts, 2; neck, 11; paralyzed parts, 1; general, 1; ankle, 1; buttocks, 1; right arm, 1; in all

muscles, 1; epigastrium, 1; hip, 3; spine, 2; limbs, 16; thigh, 6; hyperesthesia of legs and thigh, 1; lumbar region, 4; underside of legs, 1; outer side of leg, 1; abdomen, 5; back, 8; arms, 1; spine throughout, 3; joints, 3; paralyzed parts, 2; upper arm, 2; right leg, 2; left leg, 5; all over the body, 8; right arm, 1.

Restlessness, 82. Extreme, 1; slight, 1; marked, 4; during fever, 1; at times, 1; at first, 1; not when at worst, 1; twitching of muscles when asleep, 1; very, 2.

Irritability, 87. Extreme, 1; marked, 6; slight, 2; very, 1.

Stupor, 13. Last four days, 1; short time, 1; sleepy, 1; 6 days, 1.

Apathy, 33. At first, 1; marked, 1; at times, 5; slight, 1; some, 1.

Photophobia, 9. Some, 1; slight, 4; 1st 2 days, 1.

Convulsions, 4. Slight 7th day, 1; onset, 3.

Retraction of head, 33. Slight, 11; decided, 1; slight the 5th day, 1; muscles of the head seemed paralyzed, 1; marked, 1; some, 1; very little, 1; with convulsions, 1.

Rigidity of neck, 20. With convulsions, 1; not sure, 1; marked during fever, 1; slight, 6; some, 1; at first, 1.

Kernig's sign present, 30. Slight or both sides at first, 1; slight on right leg, partial, 1; bilateral, 1; right, 1; unilateral, 1; at times, 1.

Reflexes: Knee jerk absent, 69; slight, 1; greatly weakened, 1; absent on left side, 5; absent right side, 2; exaggerated, 1; left side diminished, 1.

Wrist. Absent, 17; present, 15; doubtful, 1; lessened, 1; slightly absent on left side, 1; left diminished, 1.

Abdominal. Present, 18; absent, 3; left, 3; right, 1; lessened, 1.

Plantar. Absent, 33; slight, 6; on right foot, 2; absent in right foot, 1; slight in right foot, 1; slight in left, 1; sluggish, 1; absent in left foot, 3; lessened, 1.

Babinski sign. Absent, 5; present, 7; slight, 1; doubtful, 1.

Tache cerebrale. Doubtful, 2; present, 8; absent, 5.

Pupils. Large, 5; dilated, 5; rather large, 1; irregular, 1.

Reaction. Did not react at night, 1; incomplete, 1; slight, 1; impaired, 1.

Ataxia, 6. Doubtful, 1; would not talk, 2.

Tremor, 5. Doubtful, 1; slight in right arm, 1; slight, 1; fine finger, 1.

Paralysis.

Distribution. Face: right, 5; left, 5; eyelids: right, 1; left, 4; eye movements: right, 1; left, 1; fixed, 1; squint: right, 2; left, 3.

Swallowing, 8. Slightly impaired, 2; difficult, 2.

Speech, 13. Weak, 2; thick for three days, 1; difficulty in crying, 1; not able to talk, 1; partial loss, 2; slight, 1.

Neck, 28. Weak, 3; marked, 1; slight, 1; probably, 1; slight rigidity, 1; stiff a short time, 1; rigid, 1.

Back, 24. Rigid, 1; some, 1; slight, 3; temporary, 1; partial, 1.

Abdomen, 10. Doubtful, 1; distended, 3; tender, 1; slight, 1.

Right arm, 29. Upper, 1; complete, 4; slight, 3; nearly complete, 1; partial, 1.

Left arm, 26. Upper, 1; complete, 1; slight, 3; nearly complete, 2; numbness in last stages, 1; partial, 1.

Right leg, 77. Slight, 1; partial, 4; almost complete, 4; complete, 5; 24 hours, 1; entire except flexors, 1; some muscles, 1.

Left leg, 76. Complete, 9; partial, 3; nearly complete, 1; flaccid, 1; slight, 4; some muscles.

Bladder. Complete, 1; flaccid, 1; partial, 2; retention, 1; slight for a few days, 1; involuntary action, 1; slight, 1.

Rectum, 3. Complete, 1; involuntary, 1; constipated, 1; slight at first, 1.

Respiratory muscles. Right, 9; doubtful, 1; slight, 1. Left, 8; doubtful, 1; slight, 1.

Response to Faradic current. Disappearing at once, 8; frightened child so that it could not be used, 1; left leg, 5; right leg, 6; left arm, 4; right arm, 4; left foot, 1; right foot, 1.

Response to galvanic current, 4; very sluggish, 4; retarded, 1; child very irritable, 1; left leg, 7; right leg, 10; left arm, 4; right arm, 4; face, 2.

Galvanic formula inverted, 4.

Paralysis remains. Neck, 4; left side of face, 2; right arm, 5; complete of right arm, 1; right leg, 16; back, partial, 1; left arm, 4; left arm, partial, 1; left leg, 22; bladder, 1; right upper arm, 1; left leg weak, 1; some muscles of arms and legs, 1; considerable, right leg, 1; face muscles still weak, 1; hands, 1; fingers, 1; slight, left leg, 1; slight in both lower extremities, 6; total in both lower extremities, 12; partial in both lower extremities, 7; hamstrings slightly contracted, 1; partial paralysis of thigh and big toe, 1; flexors of left foot, 1; left thigh, 1; thigh, 3; muscles, 1; leg flexors, 1; extension muscles, 2; extension muscles in right and left foot, 1; extension muscles of right leg, 1; shoulder girdle, 1.

Paralysis disappeared. Abdomen, 2; throat, 1; back, 1; some muscles of arms and legs, 1; right fore arm, 1; all, 9; slight left leg, 1; left leg, 26; bladder, 2; neck, 9; right leg, 11; left arm, 6; partial in left arm, 1; fore arm, 1; flexor of legs, 1; face, 1; speech, 1; muscles, 1; right arm, 5; rectum, 1; toes, 1; anterior muscles, 1; thigh, 1; eye, 1; walks fairly, 1; calf muscles, 1; muscles of left leg, 5; back, 8.

Sensation. Diminished, 6; slight, 1. Increased, 8. On left side, 1; to tuning fork, 1; left outer malleolus, some extent, 1.

Cerebrospinal fluid examined, 5. Findings: pressure positive, 2; clear, no cells, 1; negative, 1.

Nervous System. Summary of First Set of 150 Cases.

Paralyzed parts. Flaccid, 106; rigid, 12; delirium, 11; insomnia, 56; pain in head, 50; neck, 59; back, 65; limbs, 71; elsewhere, 15; tenderness, 90; restlessness, 82; irritability, 87; stupor, 13; apathy, 33; total, 46; photophobia, 9; convulsions, 4; retraction of head, 33; rigidity of neck, 20; Kernig's sign present, 30; total, 83. Reflexes. Knee jerk, absent, 69; wrist absent, 17; present, 15; abdominal, absent, 3; present, 18; plantar, absent, 33; Babinski sign, absent, 5; present, 7; tache cerebrale, absent, 5; present, 8; pupils large, 5; pupils dilated, 5; total, 10; ataxia, 6; tremor, 5.

The data concerning the second set of cases, to the number of about one hundred, are added, although they were compiled in many instances from memory, several months after the patients were seen. Such differences as the comparatively few cases where tenderness is noted, although photophobia was so often remarked, may be accounted for in this way. That Kernig's sign was only noted five times, while retraction of the head was declared of fifty-two cases, is a serious discrepancy. In this series of cases, the observation of the reflexes was seriously defective, so that we can attach little consideration to the declaration that Babinski's sign occurred twelve times when we see the knee reflex was remarked upon only five times in all. Again, the pupil reaction was declared to have been "slight" in five cases. The table is, however, appended without further comment.

Nervous System; Second Series, 100 Cases.

Paralyzed parts at first flaccid, 59; rigid, 18; rigid first few hours, 2. Delirium, 6; slight, 3; some, 3. Insomnia, 26; 4 days, 1; for a short time, 1. Pain in head, 77; great deal, 1; severe, 1; some, 1; slight, 1. In neck, 49; rigid at first, 1; some, 1. Back, 56; some, 4. Limbs, 56; some, 2. Pain elsewhere, 6; limbs and chest, 1; all muscles, 7; general, 2; skin, 4; back, 2; joints, 6; muscles, 11; throughout chest, 1; both legs, 2; left hand and limbs, 2; abdomen, 3; right leg, 1; arm, 1. Character of pain shooting, 1; tenderness, 11; some, 4; in limbs generally, 2; not localized, 1; muscles, 3; general, 1; joints, 2; lumbar region, 1; sides and legs, 1; skin, 7; left side of head, 1; arms, 1; legs, 1; all muscles, 2; paralyzed parts, 1; abdomen, 1. Restlessness, 58; very restless first day, 1. Irritability, 60; slight, 1. Stupor, 42; slight, 1; some, 1; later, 6. Apathy, 42; some, 1. Photophobia, 42; marked, 1; some, 3; slight, 2. Convulsions, 12; five convulsions, 1. Retraction of head, 52; slight, 1; some, 2. Rigidity of neck, 21; at first, 1; marked, 1; slight, 1; some, 2. Kernig's sign, 3. Reflexes; knee, right weak, 1; left absent, 2; right absent, 1; increased, 1. Wrist jerk brisk, 1; absent, 3. Ab-

domen brisk, 1; absent, 1. Plantar, left weaker than right, 1; absent, 2. Babinski's sign, 12. Tache cerebrale, 3. Pupils contracted, 1; large, 1; dilated, 1; normal, 1. Reaction, slight, 5. Ataxia, 8. Tremor, 6; first day, 1.

Paralysis. Face, right side, 1; left, 2; along whole cheek finally, 1. Eyelids, right, 1; left, 2. Eye movement, right, 1; left slightly impaired, 1. Squint, right, 1; some, 1; left, 2. Swallowing, 1; impaired, 3. Neck, 9; pain, 1; impaired, 1; right side, 1. Back, 7; pain, 1; impaired, 1. Speech impaired, 7; slow, 1; slight, 1. Abdomen, 2. Trunk, 9. Respiratory muscles, 8; right impaired, 1; left impaired, 1. Right arm, 31; complete, 1. Left arm, 35; complete, 1. Right leg, 88. Left leg, 79; complete, 1; slight on movement, 1. Bladder, 9; retention, 1. Rectum, 6; slight, 2; constipation, 5; doubtful, 1. Response to Faradic current: disappeared at once, 2; yes, 38. Response to galvanic current sluggish, 31; increased, 2. Galvanic formula inverted, 1.

Paralysis remains in left arm, 2; right leg, 1; complete paraplegia, 1; toes, 1; left leg, 11; slight paralysis of muscles of feet, 1; limbs, 2; right leg, 14; back, 3; muscles of eye, 2; some, 2; left hemiplegia, 1; none, 1; muscles atrophied, 1; muscles of lower limbs, 7; left side, 2; muscles of right leg, 5; right arm, 2; partial of both legs, 2; shoulder muscles, 3; very slight, 2; all, 2; partial paralysis of legs with atrophy, 2.

Paralysis disappeared; none, 9; some in feet, 2; partial in legs, 2; lower limbs, 8; slight in left leg, 10; muscles of right leg, 2; all, 2; left arm, 3; back, 2; limbs, 2; face, 1; right arm, 1; bladder, 1; rectum, 1; partial in right arm, 1; muscles of back, 1; of shoulder, 3; slight in right arm, 3. Sensation diminished, 18; markedly, 1; in leg, 1; some, 4; slight, 1. Sensation increased, 3; at first, 5. Spinal fluid, 3.

Treatment.

As to the Treatment, detailed information was rarely furnished. Massage, hot baths, strychnine and calomel were the most frequent entries in the first series of cases. As regards the second series, we can perhaps place more reliance than we were able to do concerning the symptoms reported. There was evidently a change of sentiment regarding the treatment in the period which elapsed between the first and second set of reports; because about a third of the cases of the second series are said to have been treated by galvanism. A considerable number were given potassium iodide, while very few received hot baths.

It was not possible to trace the effects of any particular treatment; for the information furnished did not enable us to gage the severity of the case or to judge what degree treatment had been efficient or persevered in.

Treatment.

	First series.	Second series.
Hexamethylenamine	16	14
Hot baths	45	14
Galvanism	13	43
Alcohol baths	0	2
Faradic current	0	10
Electricity	0	18
Massage	78	89
Strychnine	23	28
Opiates	1	1
Lumbar puncture	1	1
Calomel	22	3
Mercurial inunction	1	0
Potassium iodide	4	28
Exercise	1	0
Antipyretics	3	0
Rubefacients	17	0
Complications	3	0
Subsequent convulsions	1	0
Bromides	0	8
Hyperaemia	0	1
Deaths	9	10

QUESTIONS ASKED BY THE POLIOMYELITIS COMMITTEE OF THE MEDICAL ASSOCIATION OF THE DISTRICT OF COLUMBIA.

Patient's name.

Age. Sex. Race.

Address of patient.

Other addresses, if any, within the two months preceding onset.

Name and address of physician reporting case.

Had there been cases of infantile paralysis in the ancestors or collateral relatives?

Give the following or any other facts bearing on contagion:

Were there any other cases in the household?

If so, give name of patients.

Were these cases in the neighborhood?

If so, give names and addresses.

Had the patient within two months been associated with any person suffering from the following?

If so, give date of exposure.

Infantile paralysis. Recent case. Old case.

Any unexplained febrile attack.

Nasal catarrh.

Other respiratory catarrhs.

Sore throat.

Grippe.

Disturbance of the digestive tract.

Acute joint or muscle pains.

Neuritis.

Choreiform movements.

Landry's acute ascending paralysis.

Herpes zoster.*

Facial paralysis.

Skin eruptions.

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* Please report any recent cases of Herpes zoster in your practice, to the Committee.

Give the age and sex of each child in the family.

When did the patient last attend :

Day school. Sunday School.

Play grounds. Moving picture shows.

Other places of assemblage.

Was the patient exposed to :

Flies. Fleas. Mosquitoes.

Bedbugs or other vermin or unusual insects. (Specify.)

Was the food exposed to flies, mice or other vermin? (Specify.)

Was the house well screened?

Were there pet animals? (Specify kinds.)

Any illness among them?

Were there any errors of diet to which the patient's attack might be traced?

Was the diet breast, bottle or general?

Was the milk raw?

Did the patient have any disease during the two months previous to the attack? (Specify.)

Was the patient healthy previous to the attack?

Was there any unusual exposure to : Heat. Cold.

Dampness. Dust.

Had there been, preceding the attack, over-exertion?

An injury. Fall.

CLINICAL REPORT.

What PRODROMAL symptoms, if any, were present? (Irritability, Muscular twitchings, Apathy, Restlessness, Excessive sweating, Catarrh, etc.)

What was the duration of each prodromal symptom?

Date of onset of ACUTE symptoms.

Date of physician's first visit.

Mode of onset.

Duration of acute symptoms.

Course of fever (Furnish chart if convenient).

Any skin eruptions.

Any excessive sweating.

Circulatory System.

Were the extremities cold? Hot.

Was the heart action affected?

Pulse: Rate. Rhythm. Character.

Result of blood examination.

Result of examination of urine.

Respiratory Tract.

Was there nasal catarrh? Sneezing.

Sore throat. Cough. Bronchitis.

Respiration: Rate. Rhythm. Character.

Digestive Tract.

Appetite. Appearance of tongue. Condition of lips and mouth.

Nausea. Vomiting. Gastric indigestion.

Diarrhea. Constipation.

Was there distension of abdomen?

Character of stools.

Was there any other disturbance of the tract?

Nervous System.

Were the paralyzed parts at first flaccid or rigid?

Delirium. Insomnia.

Any pain in the head. Neck. Back. Limbs.

Or Elsewhere. Situation and character.

Any tenderness. If so, where?

Restlessness. Irritability. Stupor. Apathy.

Photophobia. Convulsions. Retraction of head.

Rigidity of the neck. Was Kernig's sign present?

Reflexes: Knee jerk. Wrist jerk. Abdominal. Plantar.

Was Babinski's sign present? Tache cerebrale.

Pupils: Size. Reaction. Ataxia. Tremor.

THE PARALYSIS.

Distribution: Face: Right. Left.

Eyelids: Right. Left.

Eye movements: Right. Left.

Squint: Right. Left.

Swallowing. Speech. Neck. Back.

Abdomen. Respiratory muscles: Right. Left.

Right arm. Left arm. Right leg.

Left leg. Bladder. Rectum.

Did response to Faradic current disappear at once?

Was response to galvanic current sluggish or increased?

Was the galvanic formula inverted?

What paralysis remains?

What paralyses have disappeared?

What sensation diminished? Increased.

Was cerebro spinal fluid examined? Findings.

TREATMENT.

Was Hexamethylenamine given?

Were hot baths given? Results.

Was galvanism used? Immediate result.

How often? or how long a period?

Give other treatment

Course of case, complications, etc.

Did the patient die? Date of death.

Was autopsy made? Results.

Will you kindly communicate any other facts you may deem important, especially any theory you may have as to the origin of the case.