Trials of these counterstaining techniques have been made on several bovine and human strains with satisfactory results. The concentrations of the alkali solutions required to stain effectively the non-acid-fast bacilli and granules of these strains, were found to be higher than those required for staining the avian bacilli. Best results for the bovine and human strains stained according to Method I, were obtained with 1 to 5 per cent. NaOH and 3 to 10 per cent. NaOH respectively, whereas the highest optimum NaOH concentration found for any of the avian cultures studied was 0.5 per cent. With Method II, both bovine and human bacilli gave effective results with saturated $NaHCO_3$. With Na_2CO_3, best results for bovine bacilli were obtained with a 5 per cent. solution, and for human bacilli with a 10 per cent solution.

Further study is being carried on to determine whether or not these staining techniques may be of use in differentiating avian, bovine, and human types of tubercle bacilli.

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SPECIAL ARTICLES

POLIOMYELITIS AS AN ESSENTIAL NERVE SYSTEM DISEASE THROUGHOUT ITS COURSE

IN 1912, Peabody, Draper and Dochez[1] in their monograph on acute poliomyelitis postulated a preliminary period of generalized systemic infection preceding invasion of the nervous tissues. Since the publication of their hypothesis and its reassertion by Draper[2] in 1917, the conception of poliomyelitis as essentially a general infectious disease with secondary and incidental invasion of the nervous system has come to be widely accepted and has largely governed medical thought in the fields of epidemiology, clinical interpretation of the early symptoms and serum treatment. That it has stood at variance with much of the experimental work—such as the great difficulty of producing the disease in apes by intravascular injection of virus, as contrasted with the great ease of producing the disease by direct applications to nervous tissue—and with certain clinical aspects of the disease in man, such as the peculiarly scattered and asymmetrical distribution of the lesions and paralyses, must be evident to any unbiased student of poliomyelitis.

An analysis of the 115 case histories given in the Rockefeller Monograph and in Draper's book with special reference to the onset symptoms shows no necessity for assuming an early phase of systemic, extranervous infection, but on the contrary that all the most frequent and characteristic onset symptoms can be explained as manifestations of infection of the central nervous system. In order of frequency, the commonest onset symptoms in the 115 cases were found to be: fever; vomiting; drowsiness, restlessness and irritability; headaches; vague symptoms, usually subjective, of discomfort or awareness of bodily disturbance; pain or hyperesthesia, and constipation. Each of these, and none of the other symptoms, occurred in more than 10 per cent. of the cases. To them should be added a peculiar psychic change which Draper regards as specific and as characteristic of the earliest hours of the disease, but is not shown in the actual protocols. Considered as a group, the symptoms are abviously of a nervous order. Moreover, these same symptoms, together with others indicating an extension in nervous involvement, almost equally characterize the later stages of the disease. It is notable that in the "dromedary" cases in which an interval of symptomatic silence separates the initial symptoms from those of the later, indubitably nervous phases of the disease, the predominant symptoms of the onset recur with significant frequency during the later phases. An analysis of the sites of residual paralysis in the large series reported by Lovett and Lucas[3] shows them to be one-sided in over three quarters of the 628 cases.

If the theory of initial, systemic invasion were correct one would logically expect: (1) a notably different symptomatology in the initial and later periods of the disease; (2) a diffuse or at least a symmetrical distribution of the lesions and paralyses. Differences in the blood supply of the two lateral halves of the bulbospinal axis, such as have been offered in explanation of the asymmetry of the lesions, probably do not exist: if they did, they would fail to explain, in the absence of gross embolism, which is not a feature of the pathology, the prevailing one-sidedness.

The clinical aspects of poliomyelitis harmonize, in my opinion, satisfactorily with the newer conception of axonal transmission of virus proposed in 1930 by Fairbrother and Hurst (which represents a return, with some modifications, to the conception of nerve-

[1] F. W. Peabody, G. Draper and A. R. Dochez, "A Clinical Study of Acute Poliomyelitis." Monographs of the Rockefeller Institute for Medical Research. No. 4, June 24, 1912.

[2] George Draper, "Acute Poliomyelitis." P. Blakiston's Son and Company, Philadelphia, 1917.

[3] R. W. Lovett and W. P. Lucas, "Infantile Paralysis. A Study of 635 Cases from the Children's Hospital, with Especial Reference to Treatment." *J. A. M. A.*, 51, 1677, November 14, 1908.

transmission held by nearly all the early investigators) and very poorly with the hypothesis of initial, extranervous invasion. The generalized lymphoid hyperplasia found post-mortem is a secondary phenomenon. The subject will be dealt with at length in a paper which has just been submitted for publication in a medical journal.

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THE NON-IDENTITY OF "PURE" AND "ISOELECTRIC" GELATINS

IN a recent text on biochemistry one of the writers (R. J. W.) made the statement, which is contrary to J. Loeb's conceptions, that "pure" and "isoelectric" gelatin are not identical. The validity of this statement and the clarity of the argument has been questioned, probably due primarily to the fact that no experimental confirmation was cited.

We have within the past year actually performed experimental work which seems to check this conclusion, and are therefore presenting it briefly at this time. The theoretical basis for the case must first be summed up.

If we possessed an organic ampholyte which by its chemical nature was exactly neutral in character, a solution containing nothing but this pure ampholyte and water would obviously be neutral in reaction and furthermore would be at its isoelectric point because the tendency to ionize as an acid and as a base would be exactly balanced.

If, however, we were to dissolve in pure water an ampholyte which is slightly more of an acid than a base, the solution would be slightly acid instead of neutral, and the material would *not* be at its isoelectric point, because by nature it ionizes more readily as $H^+ X^=$ than as $Y^+ OH^=$. In an electric field the substance should migrate to the anode because of this unbalanced tendency to ionize in the two ways. In order to bring such a solution to the isoelectric point of the ampholyte, one would have to add a small amount of acid to the solution. This would repress the acidic ionization of the ampholyte and increase its basic ionization.

Gelatin is, by any process of reasoning, a slightly acidic substance (or mixture of such substances). In its make-up there is a preponderance of acidic amino acids, and when amino acids are combined in the peptide linkage the resulting products are more strongly acidic than the original amino acids. Gelatin belongs, therefore, to the latter type mentioned above. A solution of "pure" gelatin would not be neutral and would likewise not be at the isoelectric point of the gelatin. A slight amount of acid would have to be added to bring it to this point.

Experimentally, we prepared three batches of electrodialyzed gelatin. These were washed with acetic acid and electrodialyzed according to the method used by one of us (L. F.) in previous studies on gelatin. The samples obtained yielded from 0.011 per cent. to 0.014 per cent. ash, which values are about one eighth as high as those of Loeb's "ash free" gelatin.

In three separate runs 0.5 per cent solutions of samples of electrodialyzed gelatin were subjected to from 4,600 to 5,100 volts potential in a two-compartment cell for from 70 to 90 minutes. The pH values of the original solutions in each of the cases were 5.2, 5.21 and 5.14. After subjecting the solutions to electrolysis, migration of the gelatin was noted in every case. The gelatin content of the anode portion after electrolysis was increased from 11 per cent. to 92 per cent. in the different experiments.

In another experiment a 5 per cent. solution of electrodialyzed gelatin with a pH value of 5.0 was electrolyzed in a similar manner. There was a 13.7 per cent. increase in the gelatin content of the anode compartment after electrolysis.

When one drop of normal HCl was added to a portion of the original 5 per cent. solution, the pH value was decreased to 4.52. Electrolysis of this acidified solution for 75 minutes resulted in a reversal of migration. There was a slight *decrease* in gelatin content of the anode portion, namely 2.3 per cent. This was expected, since the gelatin solution had been brought slightly to the acid side of the isoelectric point of the gelatin.

In summary we may state that when a solution containing electrodialyzed, non-ionogenic, "pure" gelatin was electrolyzed, a marked migration to the anode was noted. This appears to bear out the statement that "pure" gelatin and isoelectric gelatin are not identical. A similar statement applies to most other proteins as well as amino acids.

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AIR FILTRATION IN BACTERIOLOGICAL LABORATORIES

ONE of the conspicuous results of building operations near our laboratory during the past two years has been the increased amount of dust in the air. Laboratory tables and equipment accumulate a layer of dust if the windows are opened for any considerable time during the day. Some of the time the dirt even sifts in with the windows closed. This, coupled with the close proximity of the power house, has caused much extra work of wiping up the dust and sterilizing the table with mercuric chloride-alcohol solution. Extra care in manipulations has been nec-