crucible nor by the finest Berkefeld (W) is seen in Experiments 3 and 4.

Experiments 5 and 6 show that a Seitz E.K. filter removes it, evidence that the reactive agent is adsorbable.

Experiments 7 to 12 indicate that not all membrane filters remove the agent; the coarser filters allow it to pass, while 200 sec. filters retain it. From this it is concluded that retention of the agent by membrane filters is accomplished by sieving rather than by adsorption, and that the agent is of a particulate nature, the size of the particle being larger than the pores of a 200 sec. Zsigmondy membrane filter.

8947 P

Influence of Pathway of Infection on Pathology of Olfactory Bulbs in Experimental Poliomyelitis.

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The purpose of this communication is to describe the lesions produced by the virus of poliomyelitis when it invades the olfactory bulbs from the nose and to indicate their absence when the virus reaches the central nervous system of *Macacus rhesus* monkeys by other pathways. In monkeys succumbing to poliomyelitis after nasal instillation of virus, the olfactory bulbs show changes in the 5 outer layers, *i. e.,* the layer of olfactory nerve fibers, the glomerular, the external granular, the gelatinous, and the mitral cell layers. The lesions in the first 4 layers mentioned appear to be chiefly inflammatory, consisting of perivascular cuffing and diffuse infiltration of polymorphonuclear leucocytes, mononuclears, and lymphocytes. The involved mitral cells undergo necrosis and frequently show neuronophagia by polymorphonuclear and microglial cells.

These changes with some individual variation in extent, were observed in the olfactory bulbs of each of 10 monkeys given the virus by way of the nose, and it should be stressed that although the virus was instilled in both nostrils, the lesions were present, in at least 3 of the 10 animals studied, in only one of the olfactory bulbs. In 12 monkeys which succumbed to poliomyelitis after intracerebral, subcutaneous, or intrasciatic inoculation, examination of both olfactory bulbs revealed no lesions. It is apparent that a study of

the olfactory bulbs may be useful as an indicator of the portal of entry of the virus in experimental poliomyelitis.

Practically no attention has hitherto been paid to the pathology of the olfactory bulbs in human poliomyelitis, and it is believed that their examination in the future should yield data of value to a better understanding of the epidemiology and prophylaxis of this disease.

8948 P

Chemical Studies in Bacterial Agglutination. III. A Quantitative Theory of Bacterial Agglutination.*

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It has recently been shown possible to consider the precipitin reaction as a series of competing bimolecular reactions[1] and so derive from the mass-law an expression

$$\text{mg. antibody N precipitated} = 2RS - \frac{R^2}{A} S^2$$

in which R is the ratio of antibody to hapten or antigen in the precipitate at a reference-point in the equivalence-zone, and A is the amount of antibody-N precipitated at the reference-point. This equation describes closely the behavior of a number of immune precipitating systems.

Since the agglutination reaction may be considered a precipitin reaction at the bacterial surface, it was thought that the above theory might be applied. The test involved the development of an absolute method for the micro-estimation of agglutinin[2] and the use of a single hapten at the bacterial surface and the homologous antihapten. This was realized in a freshly washed, heat-killed pneumococcus I S (Dawson "M") suspension and, for the antibody, Type I anti-pneumococcus horse-serum freed from antibodies other than type-

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1 Heidelberger, M., and Kendall, F. E., *J. Exp. Med.*, 1935, **61**, 563; **62**, 467, 697.

2 Heidelberger, M., and Kabat, E. A., *J. Exp. Med.*, 1934, **60**, 643; PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 595.