repository aqueous solution of sodium penicillin was least effective, the suspensions of procaine penicillin in water or in oil were approximately equal in their activity, large particle size sodium penicillin in beeswax and oil was more effective, and small particle procaine penicillin suspended in oil and aluminum monostearate was the most effective preparation tested.

16911 P

Differentiation of Three Groups of Poliomyelitis Virus.*

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In a previous report in which 7 strains of poliomyelitis virus were compared by the method of challenging convalescent monkeys, Kessel and Pait[1] indicated that 4, BK, McK, Ca and Fr constituted one group, which was designated as Group A, or Group I.†

Two of the other 3 viruses studied, the La and Le, were distinct from the above 4 while the seventh, MV, appeared to exhibit an intermediate relationship. In 1946,[2] it was shown that La and Le were different by reciprocal neutralization tests.

Methods. In order to compare these relationships further, 4 of the viruses, McK, MV, La and Le were selected for reciprocal studies by 2 additional methods:

(a) challenge of vaccinated animals.

(b) Neutralization by pooled sera from the vaccinated animals. The vaccination was by the intramuscular route as recommended by Morgan,[3] the following schedule being used, 1.25 cc of 20% virus at 0, 1, 3 and 5 weeks, making a total of 1 g of infected monkey cord received by each animal. All animals were challenged with 100 $P.D._{50}$ of homologous virus by the intracerebral route at the seventh week. All immune animals were then challenged with 100 $P.D._{50}$ of a heterologous virus during the 13th week. Just prior to the heterologous challenge the monkeys were bled and their serums saved for neutralization

TABLE I.
Reciprocal Challenge of Vaccinated Animals.
Numerator equals number of monkeys showing symptoms, denominator equals number of monkeys inoculated.

Vaccinated with	Challenged with			
	McK	MV	La	Le
McK	0/12	1/3	4/5	*
MV	4/4	0/12	1/4	5/5
La	5/5	*	0/11	6/6
Le	*	*	2/4	0/4

100 PD_{50} used in challenge.
* Incomplete.

TABLE II.
Reciprocal Neutralization Tests.

Pooled serum from animals vaccinated with	Virus used in neutralization test			
	McK	MV	La	Le
McK	0/4	3/5	5/5	5/5
MV	4/4	0/4	0/4	4/4
La	5/5	2/4	0/5	4/5
Le	4/4	5/5	4/5	0/5
Controls	6/6	5/6	5/6	6/6

100 PD_{50} of virus was used.

* Aided by a grant from the National Foundation for Infantile Paralysis.

1 Kessel, J. F., and Pait, Charles E., PROC. SOC. EXP. BIOL. AND MED., 1948, **68**, 606.

† More recently 5 additional strains, Mi, from Dr. Thomas Francis, Jr.; Gu, isolated in Los Angeles; Ko, and Cp, from Dr. William M. D. Hammon; and Br, from Dr. David Bodian, have been tested and found to belong to Group I.

2 Kessel, J. F., Moore, F. J., and Pait, Charles E., *Am. J. Hyg.*, 1946, **43**, 82.

3 Morgan, I. M., Howe, H. B., and Bodian, D., *Am. J. Hyg.*, 1947, **45**, 379.

tests, a separate serum pool being made from monkeys vaccinated with each strain. In the neutralization test, the final virus concentration was 100 $P.D._{50}$ per cc and serum dilution 1:2. This mixture was incubated for 4 hours in the refrigerator just prior to intracerebral inoculation of 5 monkeys with 1.0 ml each.

Results. Tables I and II summarize the results.

Conclusions. These results in conjunction with those of the previous study indicate that 3 groups of poliomyelitis virus have been demonstrated. I. One group encompasses at least 9 viruses compared in this study: Bk, McK, Ca., Fr, Mi, Gu, Ko, Cp. and Br. This group, which includes the greatest number tested to date has been designated tentatively as Group I. II. Another group so far comprises the La and MV viruses. III. A third virus, Le, differs sufficiently from the above two groups to represent a third group.

16912 P

Relationship of Body Specific Gravity to Body Fat and Water Content.*†

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It has been demonstrated by Behnke and his coworkers[1-3] that the specific gravity of the human body can be used as an index of the proportion of fat present. Rathbun and Pace[4,5] measured the specific gravity of eviscerated guinea pigs and also analyzed the bodies chemically for the fat content. They found that the body specific gravity of the animals decreased as the fat content increased, and that the range of specific gravity for the guinea pigs closely approximated that found by Behnke in his series of normal human males. The relationship between body specific gravity of the eviscerated guinea pig and the proportion of body fat was found to be a very exact one and agreed closely with the theoretical equation:

$$\% \text{ fat} = 100 \left(\frac{5.548}{\text{specific gravity}} - 5.044 \right)$$

The use of body specific gravity as an index of the amount of body fat in humans has been examined further in this laboratory. In an effort to describe more accurately the relationship which exists between metabolic rate and age, studies are being carried out to ascertain whether the "lean body mass," *i.e.*, body weight minus the fat content, may not be a better standard of reference for the metabolic functions of the body than surface area or weight of the body.

The difficulties encountered in weighing elderly people under water, a part of the procedure for measuring specific gravity of the body, were so great that it was decided to try to measure body water instead and calculate the lean body mass from this determination. A chemical method for the measurement of total body water, by the use of antipyrine (1-phenyl-2:3-dimethyl-5-pyrazolone) was then developed in this laboratory and the values obtained agreed closely with simultaneous measurements of body water by deuterium oxide.[6]

* This investigation was supported in part by a research grant from the Division of Research Grants and Fellowships of the National Institute of Health, U. S. Public Health Service.

† Part of the expenses of this study were defrayed by the Josiah R. Macy, Jr. Foundation.

1 Behnke, A. R., *Harvey Lecture Series*, 1941-1942, **37**, 198.

2 Behnke, A. R., Feen, B. G., and Welham, W. C., *J.A.M.A.*, 1942, **118**, 495.

3 Welham, W. C., and Behnke, A. R., *J.A.M.A.*, 1942, **118**, 498.

4 Rathbun, E. N., and Pace, Nello, *J. Biol. Chem.*, 1945, **158**, 667.

5 Morales, M. F., Rathbun, E. N., Smith, R. E., and Pace, Nello, *J. Biol. Chem.*, 1945, **158**, 677.