stuffs between the cell and the environment decreases. Therefore, the probability of sufficient materials being available per cell per unit-time, to provide for the maximal possible requirement of the cells, decreases.

These results also lend further support to the hypothesis advanced by Cleary, Beard and Clifton[9] that growth may be primarily controlled by this above probability-relationship, the growth-rate decreasing as the concentration per cell of materials essential for growth decreases in cultures of bacteria in which a relatively high population has been established. The maximal population developed under favorable conditions may also be primarily controlled by these concentration-relationships.

8848 P

Cysteine-Gelatin as a Differential Medium for *Salmonella pullorum* and *Salmonella gallinarum*.

W. R. HINSHAW* AND L. F. RETTGER.

From the Department of Bacteriology, Yale University.

Differentiation of *Salmonella pullorum* from *Salmonella gallinarum* cannot be made by agglutination or agglutinin-absorption, because of a similar antigenic structure. This similarity and the fact that the 2 diseases produced in fowls are alike in some respects have caused certain European investigators[1, 2, 3] to consider them as variants of the same species.

Mallman's[4] work on the use of sodium-mucate agar, Jordan and Harmon's on tartrate-agar,[5] and Naidu's[6] and Nobrega's[7] studies on differentiation by bacteriophage, are examples of investigations which supply further evidence that these organisms are separate entities. This report deals mainly with the use of cysteine-gelatin as another differential medium.

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9 Cleary, J. P., Beard, P. J., and Clifton, C. E., *J. Bact.*, 1935, **29**, 205.

* On sabbatical leave from the University of California.

1 Miessner, H., Rept. Proc. 4th World's Poultry Cong., London, 1930, 428.

2 Wagener, K., Proc. 12th Internat. Vet. Cong., New York, 1934, **3**, 108.

3 Haupt, H., *Ergeb. der Hyg., Bakt., Immunit., u. Exper. Therapie*, 1935, **17**, 175.

4 Mallman, W. L., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 501.

5 Jordan, E. D., and Harmon, P. H., *J. Inf. Dis.*, 1928, **42**, 238.

6 Naidu, P. M. N., *Bul. Acad. Vet. France*, 1935, **8** (6), 306.

7 Nobrega, P., *Arch. do Instit. Biol. de S. Paulo, Brazil*, 1936, **6** (Artigo 9), 72.

The cysteine-gelatin was prepared according to a method used by Valley[8] for the study of anaerobic growth. Enough Difco granular gelatin is added to the 0.15% cysteine-broth described by Valley[9] to make a 12% solution. After dissolving the gelatin in a water-bath, the medium is tubed and sterilized at 15 pounds extra pressure for 15 minutes. Tubes of 12 mm. and of 16 mm. diameter were found to be equally satisfactory, when at least 5 cc. of medium were used. The cysteine-gelatin retained its potency for at least 2 months, when stored in the refrigerator and dehydration was prevented.

The action of 61 strains labeled *S. gallinarum,* 120 *S. pullorum,* and 11 *S. typhi,* was studied in this medium. Tartrate-agar[5] was inoculated with the same strains, for comparative purposes. A summary of these results is given in Table I. The tartrate-reactions support Mallman's findings. The results obtained with the 11 strains of *Salmonella typhi* are included also for record.

TABLE I.
Reactions in Cysteine-Gelatin and in Tartrate-Agar (37°C.).

Bact. species	No. of strains	Reactions in Media	
		Cysteine-gelatin*	Tartrate-agar†
S. gallinarum (fowl origin)	58	+	+
S. gallinarum (Duisburg strains)	3	—	±
S. pullorum	120	—	— to ±
S. typhi	11	±	+

* Cysteine. + = definite turbidity throughout the medium; ± = slight turbidity for the first 24 to 48 hours followed by a complete or partial clearing; — = no change.

† Tartrate. + = distinct acid reaction in the butt of the tube within 24 to 48 hours. ± = very slight acid reaction in butt in 24 hours, usually changing to alkaline in from 24 to 72 hours. Never markedly acid.

Fifty-eight of the *S. gallinarum* strains were from fowls. All gave a definitely positive reaction in cysteine-gelatin, in the form of a distinct yellowish-white turbidity when incubated at 37°C. for from 24 to 72 hours. The nature of this turbidity has not been definitely determined, but it is not due to profuse growth of the organisms. When stab-cultures of the same strain were incubated at 20°C., a zone of turbidity developed at the surface and along the line of puncture in from 48 to 72 hours. In shake-cultures a similar zone was found around each individual colony. The remaining 3 strains of *"S. gallinarum"* produced no perceptible clouding or precipitation. These were furnished through the courtesy of Dr. F.

8 Valley, George, Dept. of Bact., Yale Univ., Method unpublished, used by permission.

9 Valley, G., *J. Bact.*, 1929, **17**, 12.

Kauffmann and were designated "Duisburg." Two were isolated from human feces, and the third from salad in the Duisburg outbreak of food-poisoning reported by Müller.[10] These resembled *S. pullorum* in their deportment in cysteine-gelatin and in tartrate-agar. Kauffmann[11] also noted minor differences between these and his fowl-strains.

The 120 strains of *S. pullorum*, all from fowls, produced no changes in the cysteine-gelatin, either when incubated at 37°C. or at 20°C. The reactions of the 11 strains of *S. typhi* (all of human origin) in cysteine-gelatin more nearly resembled those of *S. pullorum* than *S. gallinarum*. (See Table I.)

8849 P

Distribution of the Sub-groups of A and the M and N Agglutinogens Among the Blackfeet Indians.

G. ALBIN MATSON, PHILIP LEVINE AND H. F. SCHRADER.

From the Department of Biology, Montana State University, the Beth Israel Hospital, Newark, N. J., and the Office of Senior Physician, Blackfeet Agency, Browning, Mont.

The original observations of Matson and Schrader[1] on the Blackfeet and Blood tribes of American Indians revealed a distribution of the 4 blood groups vastly different from what was formerly believed to be characteristic for Indians. Group A was observed to have the same high preponderance (76.5%) among these tribes as group O has among other tribes of Indians.[1, 2, 3, 4] These findings suggested that, contrary to former speculation concerning the origin of Indians, the "Blackfeet" did not separate from the rest of the human family before the A agglutinogen developed in the race.

In contrast to the characteristic differences of the two sorts of Indians with regard to the distribution of the 4 blood groups, subsequent work by us has shown that the Indians thus far studied, behave alike in having a high incidence of the M factor.[2]

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10 Müller, R., *Münch. med. Wochensch.*, 1933, **80**, 1771.

11 Kauffmann, F., *Zent. f. Bakt. I. Orig.*, 1934, **132**, 337.

1 Matson, G. A., and Schrader, H. F., PROC. SOC. EXP. BIOL. AND MED., 1933, **30**, 1380; *J. Immunol.*, 1933, **25**, 155.

2 Levine, Philip, Matson, G. A., and Schrader, H. F., PROC. SOC. EXP. BIOL. AND MED., 1935, **33**, 297.

3 Coca, A. F., and Deibert, O., *J. Immunol.*, 1923, **8**, 487.

4 Snyder, L. H., *Am. J. Phys. Anthrop.*, 1926, **9**, 233.