schemes are also being studied and will be reported elsewhere.

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[1] Kusma, J. F., and Zander, G., *Arch. Path.*, **63**, 198 (1957).
[2] Barnes, L. L., Sperling, G., McCay, C. M., and Brown, C. E., *Arch. Path.*, **66**, 529 (1958).

BACTERIOLOGY

Distribution of Nucleic Acids among Different Stable *L* Forms of *Proteus P* 18

In previous work, we have studied some enzymatic activities of various morphological kinds of stable *L* forms derived from *Proteus P* 18 (ref. 1). These enzymatic activities were highest in the fraction of small size (fraction 3, 1·9–3·8 μ) and lowest or absent in fraction 4 (≦ 0·95 μ) containing the smallest forms invisible with the phase-contrast microscope.

We decided to inquire into the distribution of ribo- and deoxyribonucleic acids in the various *L* forms separated by differential ultra-centrifugation. Four groups of different sizes were used: fraction 1, 7·6–11·4 μ; fraction 2, 3·8–7·6 μ; fraction 3, 1·9–3·8 μ; fraction 4, ≦ 0·95 μ (ref. 2).

L forms are grown suspended in a hypertonic medium by a technique already described[3]. After separation of the particles of different sizes[2], the micro-organisms are freeze-dried and crushed in cold ether. In the case of fraction 4, we examined separately the whole fraction and the fraction passing through a Chamberland 3*L*3 filter. The acid-soluble phosphorus is removed by 7 per cent trichloracetic acid and the lipids are extracted by Bloor's method. The residue is hydrolysed using Schmidt and Thannhauser's technique[4]. In the acid-insoluble fraction of the alkaline digest, deoxyribonucleotides are extracted by normal perchloric acid at 80° C. during 30 min. and deoxyribose is essayed by the Burton modification[5] of Dische's technique[6]. In the acid-soluble part of the alkaline digest, ribonucleotides are determined by the orcinol procedure of Bial modified by Mejbaum[7]. The results were confirmed by the use of phloroglucinol[8] and assay of ribonucleic acid phosphorus after adsorption of the ribonucleotides on a charcoal column followed by elution with alcohol-ammonia.

Results are given for nuclear phosphorus (Table 1). The reference curve for deoxypentose has been established with a thymus deoxyribonucleic acid purified to Kay, Simmons and Dounce's methods[9], that of ribose with a yeast ribonucleic acid purified by Smith and Markham's method[10].

Table 1 shows that fraction 3 has the highest ribonucleic acid content: 1943 ± 125 μgm. phosphorus; then come fractions 2 (1418 ± 222 μgm.) and 1 (1132 ± 99·7 μgm.), followed by fraction 4 obtained by centrifugation (439 ± 81·7 μgm.) and finally fraction 4 by filtration (285 ± 28·3 μgm.)

The deoxyribonucleic acid content is highest in fractions 1 (520 ± 40·9 μgm.) and 2 (485 ± 75·1 μgm.), much lower in fractions 3 (71 ± 7·8 μgm.) and 4 (61 ± 6·4 μgm.). In contrast, there is a high deoxyribonucleic acid in those elements of fraction 4 which pass through the Chamberland filter (389 ± 21·5 μgm.). It follows that the ratio of ribo- to deoxyribonucleic acid is lowest in the filtered fraction 4 (0·73 ± 0·05) which shows the lowest enzymatic activity. The ratio is highest in fraction 3 (27·2 ± 1·73) which possesses the highest enzymatic activity[1].

Table 1. DISTRIBUTION OF NUCLEIC ACIDS AMONG DIFFERENT L FORMS OF *Proteus P* 18 BACILLUS. Results are reported in μgm. of phosphorus for 100 mgm. of delipidated weight.

	Ribonucleic acid phosphorus	Deoxyribonucleic acid phosphorus	Col. 2/Col. 3
Whole	1459 ± 41·95	515 ± 19·13	2·83 ± 0·19
Fraction 1	1132 ± 99·7	520 ± 40·9	2·18 ± 0·14
Fraction 2	1418 ± 222	485 ± 75·1	2·93 ± 0·41
Fraction 3	1943 ± 125	71 ± 7·8	27·2 ± 1·73
Fraction 4	439 ± 81·7	61 ± 6·4	7·22 ± 0·35
Fraction 4 filtrated	285 ± 28·3	389 ± 21·5	0·73 ± 0·05

In summary, the distribution of ribo- and deoxyribonucleic acids differs in *L* forms of different sizes. It is noteworthy that the ratio of ribo- to deoxyribonucleic acid is highest in fraction 3 which is enzymatically very active and lowest in the filtered fraction 4. However, what is most striking is the high deoxyribonucleic acid content in the filtered particles of fraction 4.

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[1] Mandel, P., Feo, F., Sensenbrenner, M., and Terranova, T., *C. R. Acad. Sci., Paris*, **248**, 315 (1959).
[2] Mandel, P., Terranova, T., Sensenbrenner, M., and Feo, F., *Nature*, **183**, 194 (1959).
[3] Mandel, P., Terranova, T., and Sensenbrenner, M., *C. R. Acad. Sci., Paris*, **245**, 1469 (1957).
[4] Schmidt, G., and Thannhauser, S. J., *J. Biol. Chem.*, **161**, 83 (1945).
[5] Burton, K., *Biochem. J.*, **62**, 315 (1956).
[6] Dische, Z., *Mikrochem.*, **2**, 4 (1930).
[7] Mejbaum, W., *Z. Physiol. Chem.*, **258**, 117 (1939).
[8] Dische, Z., and Borenfreund, E., *Biochim. Biophys. Acta*, **23**, 639 (1957)
[9] Kay, E. R. M., Simmons, N. S., and Dounce, A. L., *J. Amer. Chem. Soc* **74**, 1724 (1952).
[10] Smith, J. D., and Markham, R., *Biochem., J.* **46** 509 (1950).

ANIMAL PSYCHOLOGY

Effect of a Signal Contingent upon an Advoidance Response

CONVENTIONAL shock-avoidance training usually takes the form signal-shock-response which becomes signal-response when the appropriate behaviour is learned. This operant technique has been shown to produce faster learning than the classical procedure in which the unconditioned stimulus (shock) inevitably follows the conditioned response[1,2] and is most effective when the response terminates the signal as well as avoids the shock[3,4].