obtained when a coenzyme I–tryptamine solution was read against an equally concentrated solution of tryptamine was about 0·370, corresponding to a decrease of approximately 243 times. The theoretical absorbance of a tryptamine solution containing 20 μmoles per ml. at 260 mμ would be about 65·000. This creates difficulties in explaining the drop of absorbancy solely on the basis of changes of the indole in the coenzyme I–tryptamine mixture. Since similar changes in the far ultra-violet spectrum are also observed in adenosine-5′-phosphate–tryptamine mixtures (Fig. 1, IV), the adenine moiety of coenzyme I seems to be involved in these interactions.

Attempts to isolate the products (complexes) of these interactions and study their properties are now in progress.

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[1] Alivisatos, S. G. A., in "Mechanisms of Hypersensitivity" edit. by Shaffer, J. H., LoGrippo, G. A., and Chase, M. W., 259 (Little, Brown and Co., Boston, 1959).
[2] Meyerhof, O., Ohlmeyer, P., and Mohle, W., *Biochem. Z.*, **297**, 113 (1938).
[3] Colowick, S. P., Kaplan, N. O., and Ciotti, M. M., *J. Biol. Chem.*, **191**, 447 (1951).
[4] Burton, R. M., San Pietro, A., and Kaplan, N. O., *Arch. Biochem. Biophys.*, **70**, 87 (1957).
[5] Van Eys, J., *J. Biol. Chem.*, **233**, 1203 (1958).
[6] Kornberg, A., and Horecker, B. L., in "Biochemical Preparations", **3**, 23, edit. by Snell, E. E. (J. Wiley and Sons, New York, 1953).

Nonulosaminic Acid (Sialic Acid) in Protists

Nonulosaminic acid[1], a group of simple and substituted 9-carbon sugars containing nitrogen, was thought restricted to mammals until it was found in the supernates of *Escherichia coli* and *Citrobacter freundii* cultures, but not in the supernates of *Salmonella*, *Shigella*, *Pneumococcus* or *Bacillus* cultures[2]. Nonulosaminic acid has now been found in the cells of *E. coli*[3], *Neisseria meningitidis*, *Salmonella dahlem*, and *S. djkarta*[4].

We have examined thirty species of protists for nonulosaminic acid. A minimum of 100 mgm. of cells, dried at 60° C., were hydrolysed in 1 *N* sulphuric acid for 1 hr. at 100° C. and at a concentration of 10 per cent (w/v) : 0·2 ml. of the hydrolysate was analysed for nonulosaminic acid by the Warren method[5]. Presence of nonulosaminic acid was confirmed by descending paper chromatography of the Warren chromophore with 10 per cent ethanol in water as solvent. The interfering deoxyribose chromophore remains at the starting line and fluoresces white with a Wood's lamp ; the nonulosaminic acid chromophore, R_F 0·11, fluoresces pink.

Nonulosaminic acid was found only among the Gram-negative bacteria (Table 1).

From the meagre information available nonulosaminic acid is limited to Gram-negative bacteria.

Table 1. Presence of Nonulosaminic Acid in Protists

Schizomycetes	Gram reaction	Acid content
Pseudomonadales		
Pseudomonas salinaria	−	−
Thiobacillus thioxidans	−	−
,, *thioparus*	−	−
Rhodopseudomonas palustria	−	+
,, *spheroides*	−	++
Chlorobium limicola	−	+
Eubacteriales		
Escherichia coli	−	++
Aerobacter aerogenes	−	++
Proteus vulgaris	−	+
Klebsiella pneumoniae	−	++
Lactobacillus leichmannii	+	−
Bacillus stearothermophilus	+	−
,, *subtilis* (four strains)	+	−
,, *megaterium*	+	−
,, sp. (three strains)	+	−
Sarcina lutea	+	−
Myxobacteriales		
Cytophaga sp.	−	+
Beggiotales		
Leucothrix mucor		−
Ascomycetes		
Brewers' yeast		−
Saccharomyces carlsbergensis		−
Algae		
Cyanidium calidarum		−
Anacystis nidulans		−
Synechococcus sp.		−
Protozoa		
Euglena gracilis		−
Ochromonas malhamensis		−
,, *danica*		−
,, *minuta*		−
Crithidia fasciculata (two strains)		−
Tetrahymena pyriformis		−

++, More than 2 per cent nonulosaminic acid ; +, 1–2 per cent ; −, acid not detected.

Gram-negative bacteria share common features besides the Gram reaction ; they elaborate endotoxins causing hæmorrhage in mouse tumours[6] and substances which inhibit agglutination of human blood groups[7]. Should nonulosaminic acid be generally distributed among Gram-negative but not Gram-positive bacteria it would be useful as a phylogenetic marker, especially if it should prove to have a very restricted distribution among Gram-positive bacteria. This is under study.

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[1] Stacey, M., *Endeavour*, **19**, 43 (1960).
[2] Barry, G. T., *Nature*, **183**, 117 (1959).
[3] De Witt, C. W., and Row, J. A., *Nature*, **184**, 381 (1959).
[4] Barry, G. T., Tsai, T., and Chen, F. P., *Nature*, **185**, 597 (1960).
[5] Warren, L., *J. Biol. Chem.*, **234**, 1971 (1959).
[6] Hutner, S. H., and Zahl, P. A., *Proc. Soc. Exp. Biol. Med.*, **52**, 364 (1943).
[7] Springer, G. F., *J. Immunol.*, **76**, 399 (1956).

Changes in the Levels of Adenosine Triphosphate and Glycogen in the Liver caused by Protein Administration

During a study of the influence of diet on adenosine nucleotide metabolism in the liver of the rat, we have observed that the concentration of adenosine triphosphate in the livers of well-fed animals falls rapidly when they are given a meal of protein. This change