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¹ Staudinger and Brusson, *Annalen*, **447**, 103, 110 (1926), and Carmondy, Sheehan and Kelly, *Indust. Eng. Chem.*, **30**, 245 (1938), prepared polycyclopentadienes and suggested repeating units as in (Ic) or (Id); it is possible that some of the polycyclopentadienes described in the recent patent literature are also built up according to this latter structural principle; cf., for example, Soddy, U.S.A. Patent, 2319271.

² Cf. Weiss, *J. Chem. Soc.*, 245 (1942).

³ Hausser, Kuhn and Smakula, *Z. phys. Chem.*, (B), **29**, 384 (1935). Karrer and Jucker, "Carotinole" (Basle, 1948). Blout and Fields, *J. Amer. Chem. Soc.*, **70**, 189 (1948).

⁴ Rubin, Steiner and Wassermann, *J. Chem. Soc.*, 3046 (1949).

⁵ Alder and Stein, *Annalen*, **504**, 216 (1933).

⁶ Nernst and Hohmann, *Z. phys. Chem.*, **11**, 352 (1893). Clark, Ph.D. thesis, University of Missouri (1937). Wassermann (unpublished experiments).

one is due to the diphosphate; the other one is adenosine-5-phosphate, probably obtained through a small contamination of the myosin by myokinase.

Even adenosine triphosphate from muscle gave two spots, R_F 0.83 and 0.76. The first one is due to the triphosphate, the other to the diphosphate. Adenosine triphosphate is apparently very often contaminated with adenosine diphosphate owing to the instability of the triphosphate.

Our examples show that the modification of the partition coefficient with lauryl amine in amyl alcohol very much facilitates the resolution of the different derivatives of adenosine phosphates, and is superior to Carter's original method.

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¹ Carter, C. E., *J. Amer. Chem. Soc.*, **72**, 1466 (1950).

² Kornberg, A., and Pricer, jun., W. E., *J. Biol. Chem.*, **186**, 557 (1951).

PAPER CHROMATOGRAPHY OF MUSCLE TISSUE CONSTITUENTS

Paper Chromatography of Adenosine Phosphates

CARTER¹ has devised a method for paper chromatography of adenosine phosphates. He uses as solvent a 5 per cent dibasic sodium phosphate solution and *iso*-amyl alcohol. For developing the spots after drying, he sprays the paper with fluorescein and localizes the spots with an ultra-violet lamp ('Mineralight').

We have modified the partition coefficient between the two phases by using a solution of 0.5 per cent lauryl amine in *n*-amyl alcohol instead of *iso*-amyl alcohol. The resolution of the spots has much improved by this method. We believe that this method can be adapted to other substances; thus, for substances of basic character laurylic acid can be used to improve the resolution.

We have compared our method with the original method of Carter on adenosine phosphates. With Carter's method, using an adenylic acid preparation (Merck), two spots were obtained with R_F 0.73 and R_F 0.66, and, according to Carter, who obtained identical results, identified as the adenosine-2-phosphate and adenosine-3-phosphate. Besides these substances, a smaller spot due to inosinic acid was visible. Adenosine diphosphate obtained by splitting adenosine triphosphate with myosin gave a longer spot, which sometimes seemed to consist of two spots of R_F 0.80 and 0.75. Adenosine triphosphate from muscle gave only one spot ($R_F = 0.82$), but often this was somewhat extended.

Using our method, we obtained the following components from the adenylic acid preparation, which tentatively have been identified as follows:

Substance	R_F
Inosinic acid	0.86
Adenosine-2-phosphate	0.69
Adenosine-3-phosphate	0.61
Adenosine	0.48

The component with R_F 0.69 has the same R_F -value as adenosine-5-phosphate, which can be obtained from muscle adenosine triphosphate by cautious hydrolysis or prolonged storage. The components have been identified from the discussions given by Carter¹ and Kornberg².

Adenosine diphosphate here clearly showed two spots with R_F 0.76 and 0.69 respectively. The first

A Phosphate-absorbing Protein from Muscular Tissue

IN connexion with the preparation of myosin from cardiac muscle¹, a protein containing a nucleotide has been isolated. This protein seems to be firmly bound to the actomyosin complex. However, it is freed to a certain extent when the complex is dissociated into myosin and actin. Only by treatment with organic solvents has it been possible to separate the protein from undissociated actomyosin.

The interesting feature of this substance is its ability to absorb the phosphoric acid residue, which is split from adenosine triphosphate by the enzymatic action of myosin.

The protein is not myosin. It more resembles actin, but it is not an actin in the usual sense. It does not polymerize and does not combine with myosin as actin does.

The present communication records an attempt to analyse the prosthetic group of the protein. This has been done mainly with the aid of paper chromatography and measurements of the ultra-violet absorption spectra in a Beckman spectrophotometer. The absorption curves have a maximum at 260 $m\mu$ in neutral and alkaline solutions. In acid solutions a maximum at 263 $m\mu$ is obtained, and here also the curve becomes asymmetric. This is different from that of adenylic compounds. Chromatographic measurements² by the method described elsewhere show that the preparations contain not more than two components, or sometimes only one. In the system 5 per cent dibasic sodium phosphate-0.5 per cent lauryl amine in amyl alcohol, it gives an R_F value of 0.67. In some cases a double spot is obtained with R_F 0.63 and 0.67.

After hydrolysis (0.1 *M* hydrochloric acid, 30 min. at 100° C.) two components appear in the chromatograms. One of these, with R_F 0.40, is identical with adenine, while the other, with R_F 0.85, has not yet been identified. This component seems to be some pyridine or pyrimidine derivative with basic properties. A prolonged hydrolysis causes no changes in this component, and furthermore the chromatographed substance is soluble in acids only. Milder hydrolysis (alkaline hydrolysis or 0.1 *M* hydrochloric acid, 5 min. at 100° C.) gives, in addition to the two spots of R_F 0.40 and R_F 0.85, two other spots with R_F 0.57 and R_F 0.68. The former of these may be adenosine-3-phosphate and the latter probably adenosine-5-phosphate. The component with R_F 0.68