Specific Phosphorylation of the 2'- and 3'- Positions in Ribonucleosides

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Summary Adenosine is phosphorylated in alkaline solution by sodium trimetaphosphate to yield exclusively the 2'and 3'-monophosphates.

THE reagent sodium trimetaphosphate has been reported to phosphorylate alcohols and carbohydrates in alkaline solutions.¹ During the course of an investigation into the phosphorylation of nucleosides by a variety of condensed phosphates in aqueous solution,² sodium trimetaphosphate was found to react specifically with the 2'- and 3'- hydroxygroups of a ribonucleoside.

Sodium trimetaphosphate was synthesized by annealing a long-chain sodium polyphosphate preparation (Graham's salt) at 520° for 12 hr. The product was chromatographically homogeneous,3 and was resistant to the action of E. coli alkaline phosphatase, indicating the absence of end-groups. The Table shows the results of the reaction of adenosine (0.1M) with sodium trimetaphosphate (0.33M)- $Na_3P_3O_9$) in NaOH (0.5M). The solution was heated under

- ¹ W. Feldmann, Chem. Ber., 1967, **100**, 3850. ² A. Schwartz and C. Ponnamperuma, Nature, 1968, **218**, **443**.
- ³ J. Aurenge, M. Degeorges, and J. Normand, Bull. Soc. chim. France, 1964, 31, 508.

reflux for 4.5 hr., and then fractionated on a column of Dowex 1×2 (formate) in 0.2M formic acid. The proportion of 3'- to 2'- isomers is reminiscent of that obtained from the hydrolysis of a 2', 3'- cyclic phosphate, which is a reasonable intermediate.

	Relative yields of mono- phosphate isomers (%)			Total conversion of nucleoside
Nucleoside	5′	2'	3′	(%)
Adenosine	0	42	58	31
Deoxyadenosine	37		63	2

Only 2% conversion of deoxyadenosine into nucleotide was observed, suggesting that a specific interaction of the trimetaphosphate ion with the cis-vicinal configuration of the ribonucleoside is involved.¹ In the absence of base, no reaction with adenosine could be detected.

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