

OPTICAL ROTATORY DISPERSION OF PURINE CYCLONUCLEOSIDES

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Recently studies on the optical rotatory dispersion (ORD) of nucleosides have been reported from several laboratories (1-6). In the present paper we describe the results of ORD measurement of various purine cyclonucleosides: 8,2'-anhydro-8-mercapto-9- $\beta$ -D-arabinofuranosyladenine (I) (7), 8,3'-anhydro-8-mercapto-9- $\beta$ -D-xylofuranosyladenine (II) (7), 8,2'-anhydro-8-oxy-9- $\beta$ -D-arabinofuranosyladenine (III) (8), 8,3'-anhydro-8-mercapto-9- $\beta$ -(D-2-deoxythreopentofuranosyl)adenine (IV) (9), 8,3'-anhydro-8-oxy-9- $\beta$ -(D-2-deoxythreopentofuranosyl)adenine (V) (9), 8,2'-anhydro-8-oxy-3'-O-mesyl-5'-O-acetylguanosine (VI) (10) and 8,5'-anhydro-8-mercapto-2',3'-O-isopropylidene-guanosine (VII) (10). In these cyclonucleosides the base moiety is fixed by the formation of anhydro linkage in certain angle to the furanose ring.

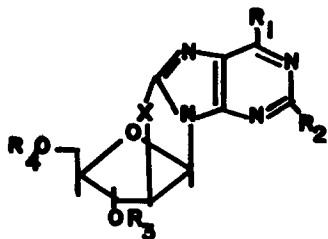
ORD measurements were made at 23° using a JASCO model ORD-UV-5 spectrophotometer. Solutions were made up to a maximum absorbancy of 1.5 and run in a 1 cm path-length cell. Average three readings were made and the maximum deviations were within  $\pm 10$  %. Solvent (water) readings were made before and after each run.

Results were summarized in Table I, Fig. 1, 2 and 3 together with their ultra-violet absorption spectra. Considering these results followings should be emphasized.

1) All purine cyclonucleosides show multiple Cotton effects. 2) Sign of the first Cotton effect is positive. 3) The ORD curves for S-cyclonucleosides are generally shifted towards bathochromic region ca. 20  $m\mu$  from those of the O-cyclonucleosides.

As shown in Fig. 1, ORD curve for compound I, for example, could be interpreted by the linear combination of more than three kinds of dispersion curves; the positive Cotton effect curve around 280  $m\mu$  corresponding to  $B_{2u}$  (11), the negative Cotton curve around 220  $m\mu$  corresponding to  $B_{1u}$  and the negative plain curve corresponding to  $E_{1u}$  below 220  $m\mu$ .

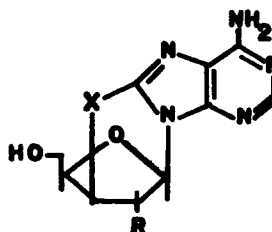
Ulbricht et al. (4) studied the ORD of pyrimidine nucleosides and showed a relationship between magnitude of Cotton effect and the angle of base moiety. As summarized in Table I, magnitude of the positive Cotton effect around major absorption band decreased from 8,3'- to 8,2'- in adenine cyclonucleosides and 8,5'- to 8,2'- in guanine cyclonucleosides according to the rotation of base around glycosidic linkage ( Fig. 4). Considering the structure of these nucleosides, in which the base moiety is fixed at the position shown by the arrow in Fig. 4, together with the fact that purine nucleoside generally has the negative Cotton effect, we are inclined to support the view that the base moiety in purine nucleoside is in syn conformation at least in aqueous solution. Recent finding of Klee and Mudd (12) that adenine nucleoside having substituted thiol group in the 5'-position showed positive Cotton effect, may be consonant with the view we have presented here. Discrepancy of our view with the previous suggestion (6) should be clarified by further investigations.



(I) X=S; R<sub>1</sub>=NH<sub>2</sub>; R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>=H

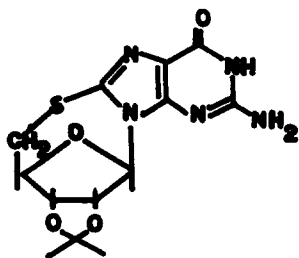
(III) X=O; R<sub>1</sub>=NH<sub>2</sub>; R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>=H

(VI) X=O, R<sub>1</sub>=OH, R<sub>2</sub>=NH<sub>2</sub>, R<sub>3</sub>=Ms,  
R<sub>4</sub>=Ac

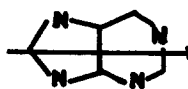


(II) X=S, R=OH

(IV) X=S, R=H



(VII)



(Direction of base)

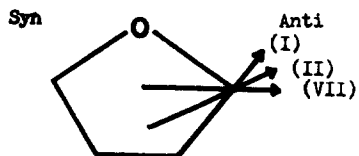


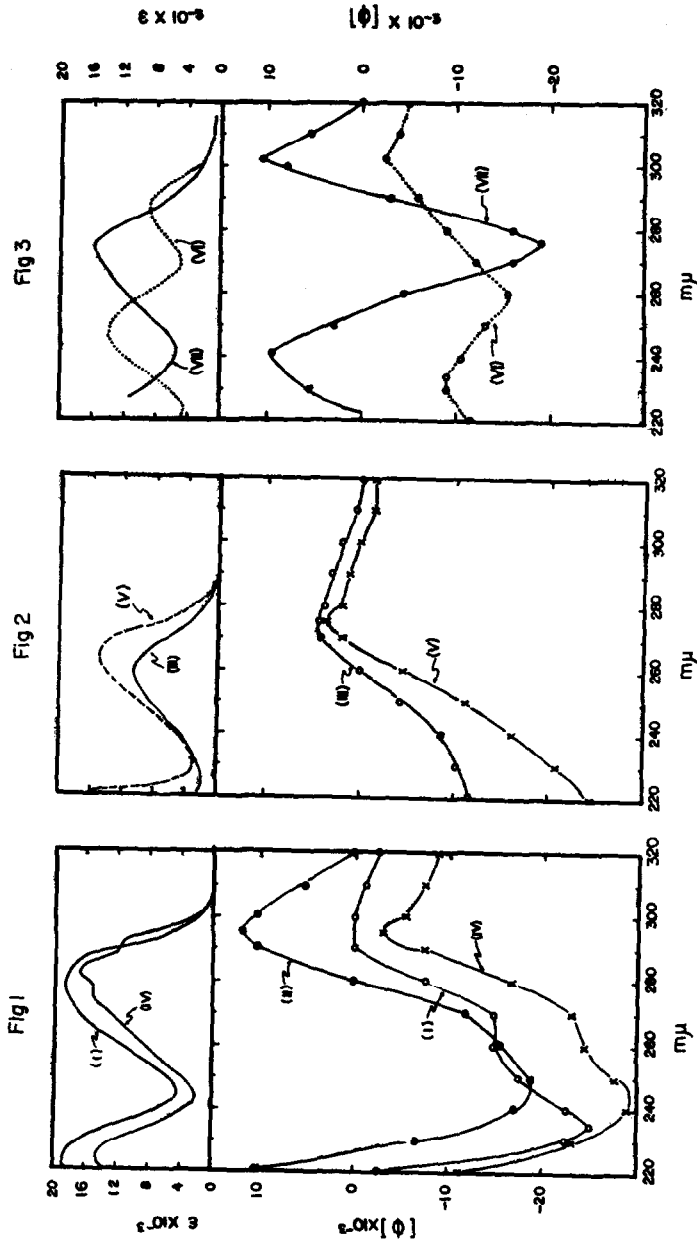
Fig. 4. Schematic representation of the position of base in purine nucleoside

TABLE I  
ORD and UV Absorption Properties of Purine Cyclonucleosides

Compound	$\lambda_p$ (m $\mu$ )	$[\phi]_p$	$\lambda_t$ (m $\mu$ )	$[\phi]_t$	Amplitude ( $\times 10^{-2}$ )	$\lambda_{max}$ (m $\mu$ )	$\Sigma$ ( $\times 10^{-3}$ )																																																								
I	295	0	235	-24900	249 <sup>a</sup>	276	18.7																																																								
			266(s)	-14900	149 <sup>b</sup>			II	295	+11900	245	-18700	306 <sup>a</sup>	281	20.3	270(s)	-11900	238 <sup>b</sup>	III	275	+4300	220 <sup>c</sup>	-11500	158	257	10.8	IV	295	-3300	245	-29000	257 <sup>a</sup>	282	16.7	270(s)	-23400	201 <sup>b</sup>	V	275	+3800	220 <sup>c</sup>	-24600	284	262.5	14.2	VI	302	-2600	258	-15500	129	247	14.1	234	-9000	286	8.9	VII	302	+10300	276	-18900	292
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p : peak, t : trough and s : shoulder.

a :  $[\phi]_p - [\phi]_t$ , b :  $[\phi]_p - [\phi]_s$ , c : Considered as a trough, which was deduced by the shifting of the curve of I 20 m $\mu$  towards short wave length region.



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