

and it can be converted to *O*⁶,5'-cyclothymidine (**4**). Based on these data and on an X-ray diffraction study of crystals of **3**,¹⁸ the stereochemistry assigned to **3** is 5(*R*)-iodo-*O*⁶,5'-cyclo-5,6(*S*)-dihydrothymidine. Furthermore, making the reasonable assumption that the epimerization of **2b** takes place at C-5, it then follows that the stereochemical representations of **2a** and **2b** are those shown above.

Treatment of **3** with base or silver nitrate produced **4**. Recrystallization from water afforded a good yield (>90%) of **4**: mp 219–220°; uv max 0.1 *N* HCl 269.5 nm (ϵ 12,550), H₂O 269.5 nm (ϵ 12,500), 0.1 *N* NaOH 268.5 nm (ϵ 9600); uv min 0.1 *N* HCl 236 nm (ϵ 2880), H₂O 236 nm (ϵ 2880), 0.1 *N* NaOH 244 nm (ϵ 4000); $pK_a = 9.68 \pm 0.05$; pmr (DMSO-*d*₆) δ 1.72 (s, 3, 5-methyl), 3.88 and 4.63 (pair d, 2, $J_{5'a,5'b} = 12.5$ Hz, H-5'), 6.74 (m, 1, H-1'), 11.17 (broad s, 1, NH); mass spectrum (70 eV) *m/e* (rel intensity) 240 (47), 222 (2), 212 (3), 194 (6), 179 (3), 168 (46), 142 (8), 140 (17), 124 (75), 98 (7), 97 (19), 96 (10), 83 (56), 81 (100), 69 (30). *Anal.* Calcd for C₁₀H₁₂N₂O₅: C, 50.00; H, 5.00; N, 11.62. Found: C, 50.20; H, 5.04; N, 11.55. Mild acid hydrolysis of **4** gave 6-hydroxythymidine and 5-methylbarbituric acid, its mass spectrum exhibits a fragmentation pattern char-

acteristic of *O*⁶,5'-cyclo-5,6(*S*)-dihydrothymidine by catalytic hydrogenation [R. Duschinsky, *et al.*, *J. Med. Chem.*, **10**, 47 (1967)].

(18) X-Ray examination of the crystals showed that they were orthorhombic, belonging to the unique space group *P*₂₁₂₁₂. Their density (2.026 g/ml at 25°), as determined by flotation, and their unit cell dimensions corresponded to four molecules per unit cell, with cell parameters *a* = 14.28, *b* = 12.14, and *c* = 6.87 Å.

The intensities of 1600 unique reflections (corresponding to the copper sphere) were measured on a Picker diffractometer with a molybdenum target and a graphite monochromator. A Patterson synthesis showed the position of the iodine and a Fourier synthesis based on the iodine indicated 18 peaks, of which the 17 highest were shown by least-squares refinement to be nonhydrogen atoms. The structure refined to an *R* factor of 0.11 when isotropic temperature factors were used and it refined to 0.075 anisotropically. A complete description of the X-ray determination of the structure of **3** will be presented in a forthcoming publication by Demetrius Tsernoglou and Jaime A. Rabi.

acteristic of *O*⁶,5'-cyclonucleosides,¹⁹ and the pmr spectrum is in agreement with the assigned structure, including the fact that the H-5' pattern is characteristic of cyclonucleosides which have an oxygen cyclonucleoside bond to C-5',^{3,20}

The conversion of **2b** through **3** to **4** is consistent with the premise that the base-catalyzed conversion of 5-halogenonucleosides to *O*⁶,5'-cyclonucleosides involves an *addition-elimination* mechanism. It should be emphasized, however, that the 5-methyl group in **2b** and **3** precludes the possibility of a keto-enol equilibrium, in which C-5 participates, intervening in their transformation to **4**. This is in direct contrast to a conversion such as 5-iodouridine to *O*⁶,5'-cyclo-5,6(*S*)-dihydrothymidine by means of base. In this latter case, such a keto-enol equilibrium involving a proton on C-5, rather than a methyl group, is possible in the corresponding saturated 5,6 adduct. The stereochemically most stable intermediate will be formed, therefore, regardless of the initial mode of addition in the formation of the 5,6 adduct.

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(19) The mass spectra of three cyclonucleosides (*O*⁶,5'-cyclo-5,6(*S*)-dihydrothymidine, *O*⁶,5'-cyclo-5,6(*S*)-dihydrouridine, and *O*⁶,5'-cyclo-5,6(*S*)-dihydrocytosine) show a number of characteristic features when compared with the corresponding parent nucleosides. Some of these characteristics are: (1) they have large parent peaks; (2) sugar residue (S) peaks are absent; (3) B + 2H peaks are very small or absent; and (4) an important peak, at *m/e* 154 for the two uracil derivatives and at *m/e* 168 for the thymine derivative, which is due to a fragment containing portions of both the base and sugar. The mass spectroscopy of nucleosides, cyclonucleosides, and derivatives of these will be treated in detail in a forthcoming publication (E. G. Lovett and D. Lipkin).

(20) I. Doerr and J. J. Fox, *J. Amer. Chem. Soc.*, **89**, 1760 (1967).

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Additions and Corrections

Photochromism of [2.2]Metacyclophan-1-enes and the Thermal Isomerization of 4,5,15,16-Tetrahydropyrenes [*J. Amer. Chem. Soc.*, **92**, 3681 (1970)]. By CHESTER E. RAMEY and V. BOEKELHEIDE, Department of Chemistry, University of Oregon, Eugene, Oregon.

At the beginning of the paragraph at the top of the second column on page 3682, the line should read: Because of the ease with which the photoisomers (**6**, **7**, and **8**) revert back . . .

Additionally, in the Experimental Section, the opening sentence should read: Two solutions each were prepared by dissolving **3** (5.8 and 5.9 mg, respectively), **4** (5.8 and 4.6 mg, respectively), and **5** (5.0 and 5.4 mg, respectively) in 5.5 ml of cyclohexane in each case.

Nuclear Magnetic Resonance Evidence for *cis*-Peptide Bonds in Proline Oligomers [*J. Amer. Chem. Soc.*, **92**,

6191 (1970)]. By C. M. DEBER, F. A. BOVEY, J. P. CARVER, and E. R. BLOUT, Department of Biological Chemistry, Harvard University Medical School, Boston, Massachusetts 02115, and Bell Telephone Laboratories, Inc., Murray Hill, New Jersey 07974.

On page 6192, column two, the fourth sentence of the first paragraph should read: By correlating the nmr spectra with optical rotation changes, it is apparent that the lower field peak (in CDCl₃) at τ 5.25 corresponds to the *trans* form.

Application of Solvent Effects to the Study of Diamagnetic and Paramagnetic Ring Currents [*J. Amer. Chem. Soc.*, **93**, 556 (1971)]. By F. A. L. ANET and G. E. SCHENCK, Department of Chemistry, University of California, Los Angeles, California 90024.