# The Stereochemistry of Taxinine: *X*-Ray Analysis of 2,5,9,10-Tetra-*O*-acetyl-14-bromotaxinol

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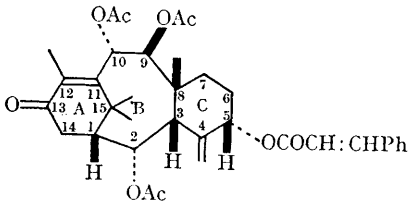
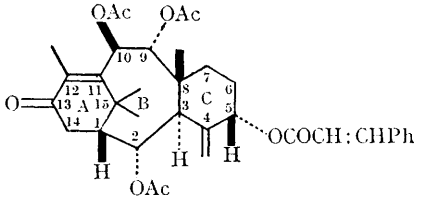
RECENTLY, Nakanishi, Uyeo, and their collaborators[1] proposed stereostructure (I) for taxinine, a constituent of the leaves of *Taxus cuspidata*, Sieb. et Zucc., *Taxaceae*. It was, however, highly desirable to define the stereochemistry of this diterpenoid unequivocally by the use of *X*-ray analysis. Among the derivatives of taxinine containing a heavy atom in the molecule, the one, 2,5,9,10-tetra-*O*-acetyl-14-bromotaxinol (II), $C_{28}H_{39}O_9Br$, m.p. 210—211° (from methanol), obtained by direct monobromination of 2,5,9,10-tetra-*O*-acetyltaxinol[2] at room temperature in carbon tetrachloride containing hydrogen bromide, was a compound of choice for studying the stereochemistry by a direct determination of the crystal structure carried out from July 1965 by the *X*-ray group at the Shionogi Research Laboratory.

2,5,9,10-Tetra-*O*-acetyl-14-bromotaxinol crystallized in the orthorhombic system, space group $P\,2_12_12_1$, with four molecules of $C_{28}H_{39}O_9Br$ in a

unit cell with dimensions $a = 18{\cdot}55$, $b = 10{\cdot}22$, $c = 15{\cdot}29$ Å. Three-dimensional intensity data were collected on a Hilger–Watts linear diffractometer[3] (with Mo-$K_\alpha$ radiation) equipped with $SrO–ZrO_2$ balanced filters. In the first seven layers were measured a total of 1528 independent reflexions (larger than the standard deviation of its



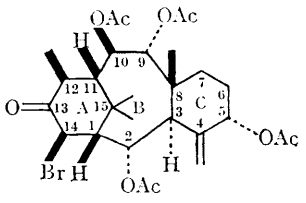

(I)



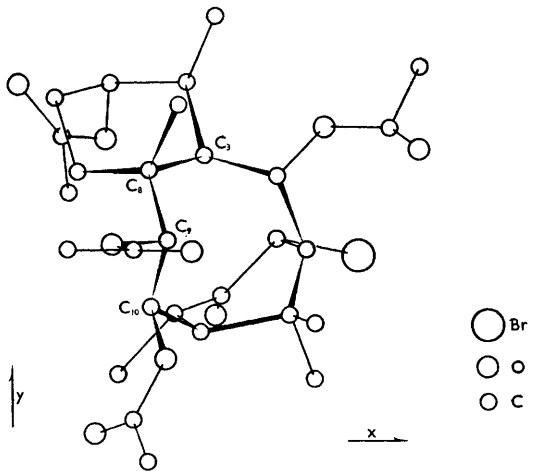

(III)

measurements) with which the analysis were carried out. The structure was sought by the heavy-atom procedure using Sim's weight technique[4] and refined by the three-dimensional block-diagonal least-squares methods. The refinement was based on 495 exact reflexions (rejecting the intensities of lower indices with extremely strong extinction effect and those smaller than 250 counts). At the present stage of refinement, the $R$-factor is 8% for 495 reflexions used. The arrangement of atoms within the molecule as seen when viewed along $c$-axis is shown in the Figure.

Based on the stereochemistry of 2,5,9,10-tetra-*O*-acetyl-14-bromotaxinol thus elucidated crystallographically, it can now be concluded that taxinine must be represented by formula (III)* which differs from that shown in (I) in the configuration at the carbon atoms (3), (9), and (10). The calculations were performed on the IBM 1620




(II)




The molecular structure as viewed along the c axis

computer at the Shionogi Research Laboratory and the CDC G-20 Computer at the C. Ito Computer Center.

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* After this work was completed, we were informed by Professor B. Lythgoe in a private communication dated December 3rd, 1965 that he and his co-workers reached the same conclusion on the basis of degradative studies. We thank him for sending us a copy of their paper prior to publication.

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[3] U. W. Arndt and D. C. Phillips, *Acta Cryst.*, 1961, **14**, 807.
[4] G. A. Sim, "Computing methods and the phase problem in *X*-ray crystal analysis", Pergamon Press, 1961, p. 227.