

synthesis. Additional experiments show that the cytotoxic action of thiols is also due to peroxide.⁸ Evidently, some cell constituent(s) are highly sensitive towards H_2O_2 . Therefore, H_2O_2 should always be considered as a potential cytotoxic agent and/or as an efficient inhibitor of RNA synthesis in aerobic biochemical and biological systems containing thiols or other autoxidizable materials. These effects can be prevented by catalase or by peptide FV. Catalase rapidly decomposes H_2O_2 formed in reaction (1). FV has no H_2O_2 decomposing activity⁹ but prevents the formation of H_2O_2 by inhibiting reaction (1). Reaction (1) requires trace amounts of metal catalyst. FV was found to bind metal ions, especially copper, and by doing so to inhibit generation of H_2O_2 and aerobic oxidation of thiols.⁹ This peptide has also been shown to counteract the inhibition of RNA synthesis caused by thiols in lymphocytes.¹¹

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The Absolute Configuration of α -(Benzotriazolyl-1)propionic Acid. Synthesis of α -(4,5,6,7-Tetrahydrohydrobenzotriazolyl-1)propionic Acid

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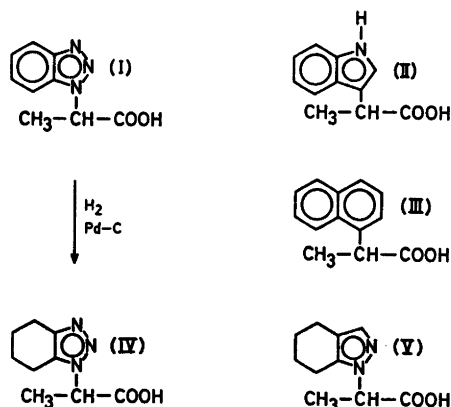
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α -(Benzotriazolyl-1)propionic acid (I) has been resolved by Fredga and Lindgren.¹ Its absolute configuration has now been determined by X-ray powder photogram studies and CD measurements.

Attempts were first made to correlate I with α -(indolyl-3)propionic acid (II) of known configuration² by the quasi-racemate method.³ However, neither melting-point diagrams nor X-ray powder photograms gave any indication of formation of quasi-racemates or solid solutions.

The acid I was then tested against α -(naphthyl-1)propionic acid (III).⁴ Here the great difference in melting-point ($\sim 120^\circ\text{C}$) is not favourable for thermal analysis. X-Ray powder photograms showed no quasi-racemate, but (+)-I and S-(+)-III gave solid solutions indicating the same absolute configuration. Thus (+)-I has R-configuration.

(-)-I was also hydrogenated yielding (-)- α -(4,5,6,7-tetrahydrobenzotriazolyl-1)propionic acid (-IV) (Scheme 1). The CD-spectrum of



Scheme 1.

(-)-IV was compared with that of S-(+)- α -(4,5,6,7-tetrahydroindazolyl-1)propionic acid (+V), whose absolute configuration is known.⁵ (-)-IV and S-(+)-V give the same type of CD-curves (Fig. 1). This is also the case for (+)-I

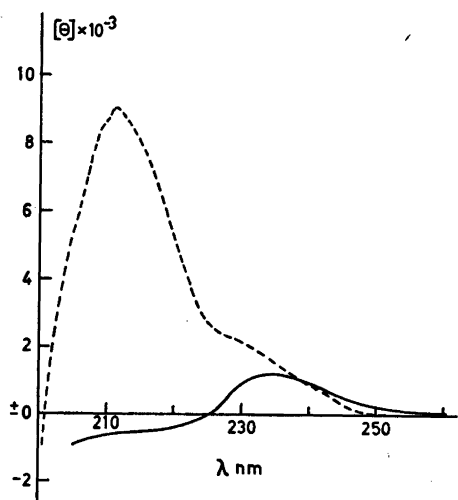


Fig. 1. CD spectra of *S*-(-)-IV (---, $c = 3.26 \times 10^{-2}$ g/100 ml) and *S*-(+)-V (—, $c = 4.04 \times 10^{-2}$ g/100 ml) in methanol.

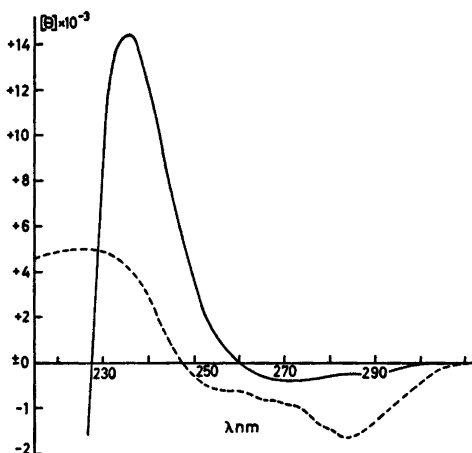


Fig. 2. CD spectra of *R*-(+)-I (---, $c = 3.52 \times 10^{-2}$ g/100 ml) and *S*-(+)-II (—, $c = 3.30 \times 10^{-2}$ g/100 ml) in methanol.

and *S*-(+)-II (Fig. 2). We have here additional evidence for the *R*-configuration of (+)-I.

Experimental. The UV spectra were recorded on a Bausch-Lomb Spectronic 505 spectrophotometer and the IR spectra on a Perkin-Elmer 157 spectrophotometer in KBr pellets. The ^1H NMR spectra were recorded on a Varian A-60 instrument using sample solutions of about 10 % and tetramethylsilane as internal standard. The optical activity was measured with a Perkin-Elmer 141 spectropolarimeter in micro cells of 10 cm length. The CD curves were

recorded in 1 ml cells in methanol solutions with a Cary 60 spectropolarimeter equipped with a CD accessory and the mass spectra recorded at 70 eV with an LKB 9000 instrument. The X-ray powder photograms were taken with a Guinier-Hägg camera using $\text{CrK}\alpha_1$ radiation.

The thin layer chromatograms were run in 20 % acetic acid-benzene on non-activated plates (E. Merck) coated with silica gel F 254 with a nominal thickness of 0.25 mm. The chromatograms were examined under UV light or developed with iodine vapour.

The melting points were determined with a hot stage microscope and are uncorrected. The micro analyses were carried out in the analytical department of the institute.

R,S- α -(4,5,6,7-Tetrahydrobenzotriazolyl-1)propionic acid (IV). 0.40 g *R,S*-I was dissolved in 4.0 ml 96 % ethanol and 0.80 g 10 % palladium-on-charcoal was added. Hydrogenation was carried out in an autoclave at a hydrogen gas pressure of 90 atm for 22 h at 75 °C with shaking. The catalyst was then filtered off and washed with a small amount of 96 % ethanol. The solvent was evaporated and the residue tested by thin layer chromatography. In addition to IV ($R_F = 0.53$) a small amount of I ($R_F = 0.63$) was indicated. A small spot at $R_F = 0.75$ was probably the ester of IV.

The product was dissolved in a small amount of warm 96 % ethanol and warm ligroin (b.p. 60–71 °C) was added. After cooling 0.045 g pure IV was obtained. M.p. 197–198 °C. ^1H NMR (DMSO- d_6): δ 1.70 (m and d, $-\text{CH}_2-$

and CH_2-), δ 2.52 (complex m, $-\text{CH}_2-\text{C}=\text{C}-$), δ 5.28 (q, $\alpha\text{-H}$). λ_{CO} 5.8 μm . UV: λ_{max} 230 nm ($\log \epsilon$ 3.67).

[Found (195.2, MS): C 55.31; H 6.73; N 21.29. Calc. for $\text{C}_9\text{H}_{13}\text{N}_3\text{O}_2$ (195.2): C 55.37; H 6.71; N 21.53.]

S-(+)- α -(4,5,6,7-Tetrahydrobenzotriazolyl-1)propionic acid (-IV). 0.20 g (-)-I was dissolved in 4.0 ml 96 % ethanol and hydrogenated in the same way as described above with 0.40 g 10 % palladium-on-charcoal as catalyst. 0.053 g (-)-IV was obtained after two recrystallizations. M.p. 187.5–188 °C. $[\alpha]_{\text{D}}^{25} = -19.9^\circ$, $[\alpha]_{\text{SES}}^{25} = -56.7^\circ$ (c 0.1410, 96 % ethanol). The acid was chromatographically pure.

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