A General Method for the Synthesis of Optically Active \( \beta \)-Hydroxy Acids

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Racemic methyl hydrogen \( \beta \)-acetoxylglutarate, a viscous, slightly hygrosopic liquid with b.p. 150°/0.5 torr (slight decomposition), \( n_D^\circ = 1.4470 \) and \( \alpha_D^\circ = 1.324 \), was made from the known anhydride of \( \beta \)-acetoxylglutaric acid \(^{1,2}\) and methanol. The optically pure antipodes of this half-ester were obtained in about 30% yield by fractional crystallization of the cinchonidine and strychnine salts from ethyl acetate and chloroform-ether, respectively. They are liquids with \( [\alpha]_D^\circ \pm 6.1^\circ \) (chloroform; c 20; l 1). Electrolysis of the dextrorotatory antipode with propionic acid gave, via the acetylated methyl ester, \( \beta \)-hydroxyhexanoic acid (I) with m.p. 42° and \( [\alpha]_D^\circ = -28^\circ \) (chloroform; c 2; l 1). As this acid is known to have the \( \beta \)-configuration \(^3\), formula II represents the Fischer projection of the dextrorotatory half-ester. It may be named \((+)-methyl 3\)-acetoxyl-4-carboxybutanoate. \( \alpha \) and \( [\alpha]_D^\circ \).

Electrolysis of the levorotatory half-ester with \( \alpha \)-heptanoic acid gave similarly 3 L-hydroxyhexanoic acid with m.p. 48.4°; \( [\alpha]_D^\circ = +20^\circ \) (chloroform; c 2.5; l 1); \( -3^\circ \) (ethanol; c 2.5; l 1). The antipode of this acid has been isolated from natural sources \(^4,5\) and it follows that this has the \( D \)-configuration (III). Cf. \(^6\) A specimen kindly supplied by professor S. Bergström gave in equimolecular mixture with the synthetic acid the racemic 3-hydroxyhexanoic acid with m.p. 56.6°. Skogh \(^7\) reports m.p. 56.4°–56.6°. Apparently optically pure \( \beta \)-hydroxyhexanoic acid with \( [\alpha]_D^\circ +22^\circ \) (ethanol) has been obtained by degradation of ricinoleic acid \(^8\). From the foregoing it seems highly probable that it has the \( D \)-configuration. Ricinoleic acid should thus be \( 12\)-hydroxy-\( \alpha \)-cis-9-octadecenoic acid.

It is obvious that the optically active half-ester (II) and its antipode can be used as starting material for the synthesis of a great many optically active hydroxy-compounds of the type \( \text{RCH}_2\text{CHOHCH}_2\text{R'} \).

A full account of this work will be published later. Grants from Norges Almennoenskapelige Foreskningsråd and from Statens Medicinsk Foreskningsråd are gratefully acknowledged.


Received June, 7, 1955.

Acta Chem. Scand. 9 (1955) No. 5