

way from 12 α -hydroxycholesterol to cholic acid that does not entail the intermediary formation of deoxycholic acid. In the rabbit, however, this 7 α -hydroxylase is lacking and the results obtained show that there obviously exists such a pathway in this species. The yield of cholic acid from 12 α -hydroxycholesterol in the rabbit was rather low, about 10 % of the excreted isotope, while the main product was deoxycholic acid. The present experiments show that the rabbit liver is capable of converting 12 α -hydroxycholesterol to cholic acid but do not form any basis for conclusions concerning the possibility that 12 α -hydroxycholesterol might be an intermediate in the conversion of cholesterol to cholic acid. The rather low yield of cholic acid does not necessarily mean that this compound is no intermediate, as the metabolism of an intraperitoneally administered compound might not be comparable to that of one formed *in situ*.

Further work is needed to clarify the role of 12 α -hydroxycholesterol in bile acid biogenesis.

Acknowledgements. This work is part of investigations supported by *Statens Medicinska Forskningsråd*, Sweden, and the *National Institutes of Health*, Bethesda, Md. (Grant H-2842).

The valuable technical assistance of Mrs. B. Berséus and Miss M.-L. Reinius is gratefully acknowledged.

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Received July 19, 1962.

The Preparation of *gem* Dithiols under Mild Conditions

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gem Dithiols have been prepared from carbonyl compounds and hydrogen sulphide under pressure¹, from dibenzylketone and hydrogen sulphide in ethanol at ordinary pressure using hydrogen chloride as a catalyst² and by the reduction of duplodithioacetone with sodium in liquid ammonia³.

During the study of duplodithioketones it was found that ketimines easily add hydrogen sulphide in ether solution at temperatures between -40° and 0°C. After acidifying with dilute hydrochloric acid and extracting the amine hydrochloride with water, *gem* dithiols could be obtained, sometimes in good yields.

In some instances it is not necessary to prepare the ketimine. It is quite sufficient to add the amine to an ether solution of the ketone and pass hydrogen sulphide into the solution at low temperature. The yields are improved if anhydrous potassium carbonate is added to the reaction mixture in order to remove the water formed during the reaction. In both cases the products seem to be quite pure, byproducts with higher boiling points being absent. The products give a positive test for *gem* dithiols with lead acetate in ethanol¹ and a positive test for sulfhydryl with sodium nitroprusside. Infrared absorption shows a strong absorption maximum at 3.96–3.98 μ .

Experimental. (A) *Gem* Dithiols from ketimines. 30 g pentyldene-(3)-butylamine⁴ was dissolved in 200 ml dry ether and hydrogen sulphide was passed into the solution at -30°C. The reaction mixture became cloudy and a crystalline compound separated. The absorption of hydrogen sulphide was very rapid; when absorption at -30° ceased the temperature was allowed to rise to 0° and hydrogen sulphide was bubbled through the solution for a further 5 h. The flask and contents were cooled to -20° and 5 M hydrochloric acid was slowly added with stirring until the aqueous phase gave an acid reaction. The ether phase was separated, the aqueous phase extracted with ether and the

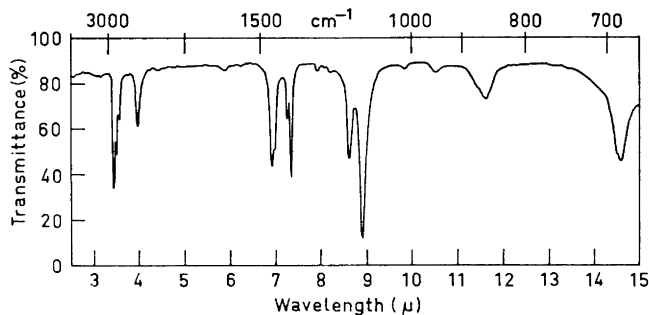


Fig. 1. Infrared spectrum of 2,2-dimercaptopropane.

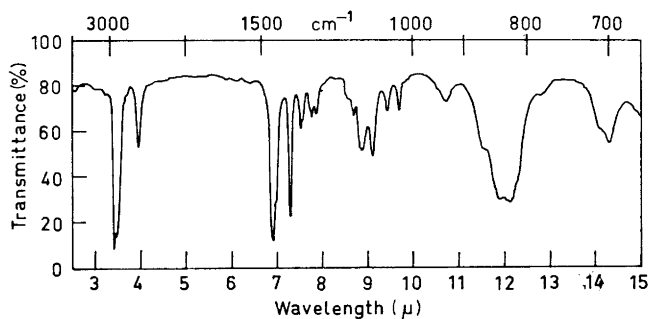


Fig. 2. Infrared spectrum of 3,3-dimercapto-pentane.

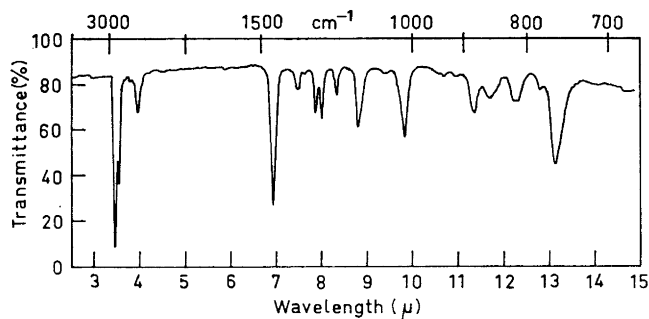


Fig. 3. Infrared spectrum of 1,1-dimercaptocyclohexane.

combined ether solutions were washed with water and dried with anhydrous sodium sulphate. The ether was removed by distillation and the product distilled through a 30 cm Widmer column. After a small forerun of a low-boiling red fluid the 3,3-dimercaptopentane¹ came over as an almost colourless fluid. Yield 24 g (83 %). B.p./12 mm 54°,

$n_D^{22} = 1.5053$. (Found: C 44.16; H 8.80; S 47.03. Calc. for $C_5H_{12}S_2$: C 44.07; H 8.88; S 47.06). Ir-Spectrum see Fig. 2.

2,2-Dimercaptopropane¹ was obtained from propylidene-(2)-butylamine in 56 % yield. IR-Spectrum see Fig. 1.

B) *gem* Dithiols from ketones. 58 g Acetone and 10 g butylamine were dissolved in 200 ml dry ether in a 500 ml flask equipped with stirrer, gas-inlet tube, thermometer and calcium chloride guard tube. 100 g anhydrous potassium carbonate was added, the stirrer was started and the mixture cooled to -20° . Hydrogen sulphide was passed into the solution for one hour. The temperature was then allowed to rise to 0° and hydrogen sulphide was passed into the mixture for further 5 h. The potassium carbonate was filtered off and washed with ether, the washings were added to the ethereal reaction product, which was then cooled to -20° and acidified with 5 M hydrochloric acid, the product being then worked up as in A. Yield 49 g 2,2-dimercaptopropane¹ (45 %). B.p./100 mm 57° . $n_D^{22} = 1.5088$. (Found: C 33.38; H 7.36; S 59.13. Calc. for $C_3H_6S_2$: C 33.29; H 7.45; S 59.26).

1,1-Dimercaptocyclohexane¹ was obtained from cyclohexanone in 78 % yield. B.p./2.3 mm 51° , $n_D^{20} = 1.5476$. (Found: C 48.40; H 8.13; S 42.97. Calc. for $C_6H_{12}S_2$: C 48.60; H 8.16; S 43.25). IR-Spectrum see Fig. 3.

3,3-Dimercaptopentane was obtained from diethylketone in 12 % yield.

d,l-Camphor, dibenzylketone and 2-indanone did not give a dithiol using method B.

After this manuscript has been completed the work of Djerassi and Tursch⁵ describing a somewhat similar method of preparing *gem* dithiols became available to the present author.

Acknowledgement. The author is very indebted to professor A. Fredga for his kind interest in this work.

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Received July 23, 1962.