

kindly supplied by Dr. G. Slomp, The Upjohn Company, Kalamazoo, Mich., USA. After the elimination of the secondary β -hydroxyl in PGE the double bond migrates into the position indicated in (III).

The two isomeric compounds PGF₁ and PGF₂ must thus have structure IV and only differ in the steric position of the hydroxyl formed by reduction of the carbonyl. Compounds of this type do not seem to have been found in nature earlier. A cyclopentenolone nucleus occurs in the "pyrethrins" present in *Pyrethrum* flowers, cf. pyrethrolone (V).

It does not appear unlikely that the prostaglandins are representatives of a group of hormonal compounds of general importance. Their high biological activity makes pharmacological exploration of the activity of similar compounds of interest.

A full report of this work will be published in this journal.

This work has been supported by the Foundations *Therese och Johan Anderssons Minne* and *Gustaf och Thyra Svenssons Minne*. We are also greatly indebted to The Upjohn Company, Kalamazoo, Mich., USA.

1. Goldblatt, M. W. *Chem. & Ind. London* **52** (1933) 1056.
2. v. Euler, U. S. *Scand. Arch. Physiol.* **81** (1939) 65.
3. Bergström, S. and Sjövall, J. *Acta Chem. Scand.* **14** (1960) 1701.
4. Bergström, S., Krabich, L., Samuelsson, B. and Sjövall, J. *Ibid.* **16** (1962). *In press.*
5. Bergström, S. and Sjövall, J. *Ibid.* **14** (1960) 1693.
6. Ryhage, R. and Stenhagen, E. *J. Lipid Research* **1** (1960) 361.
7. Bergström, S., Eliasson, R., v. Euler, U. S. and Sjövall, J. *Acta Physiol. Scand.* **45** (1959) 133.
8. Bergström, S., Dunér, H., v. Euler, U. S., Pernow, B. and Sjövall, J. *Ibid.* **45** (1959) 145.
9. *Rules for I.U.P.A.C. Notation for Organic Compounds*, Longmans, London 1961.

Received December 12, 1961.

Studies on Ester Sulphates

13. On the Enzymic Synthesis of Steroid Disulphates *

BO WENGLÉ and HARRY BOSTRÖM

From the Department of Metabolic Research, Wenner-Gren Institute, University of Stockholm and the Pediatric Clinic, Karolinska Sjukhuset, Stockholm, Sweden

Formation of monosulphates of certain steroids in microsome-free liver extracts has been reported by several workers¹⁻⁴. Evidence of the occurrence in rat liver supernatant fluid of two different steroid sulphokinases was presented by Nose and Lipmann in 1958⁵. One of these enzymes, dehydroepiandrosterone sulphokinase, was also shown to react with pregnenolone and androsterone, both of which have a hydroxyl group in the 3-position. The other enzyme was capable of sulphurylating the phenolic hydroxyl group of oestrone. On the other hand, no results with bearing on the enzymic *in vitro* formation of disulphates of steroids have so far been reported in the literature. In the present paper, an account is given of certain findings indicating the *in vitro* synthesis of steroid disulphates.

Androst-5-ene-3 β -17 β -diol **, in a final concentration ranging from 0.016 to 0.083 mM, was incubated for 120 min at 37.5°C in open test tubes, in a medium containing the following constituents: (1) 50 μ l of a buffer solution containing equal parts of 0.3 M KH₂PO₄ (pH 6.8), 0.03 M K₂SO₄ and 0.005 M MgCl₂; (2) 20 μ l of 0.02 M ATP disodium salt***; (3) 50 μ l of microsome-free supernatant fluid of female rat liver, homogenized in 2-3 volumes of 0.15 M KCl containing 0.001 M EDTA (pH 7.0), centrifuged at 105 000 *g* for 60 min, and diluted to contain 10 μ g of protein per μ l; (4) 0.1 mC of carrier-free ³⁵S-labelled sulphate †. Final volume of the incubation mixture: 120 μ l. The steroid was added to the empty

* Supported by grants from the *National Institutes of Health*, Bethesda, U.S.A. (A-4410).

** Kindly placed at our disposal by Schering A.-G., Berlin, Germany.

*** Obtained from Sigma Chemical Company, St. Louis, U.S.A.

† Obtained from the Radiochemical Centre, Amersham, England.