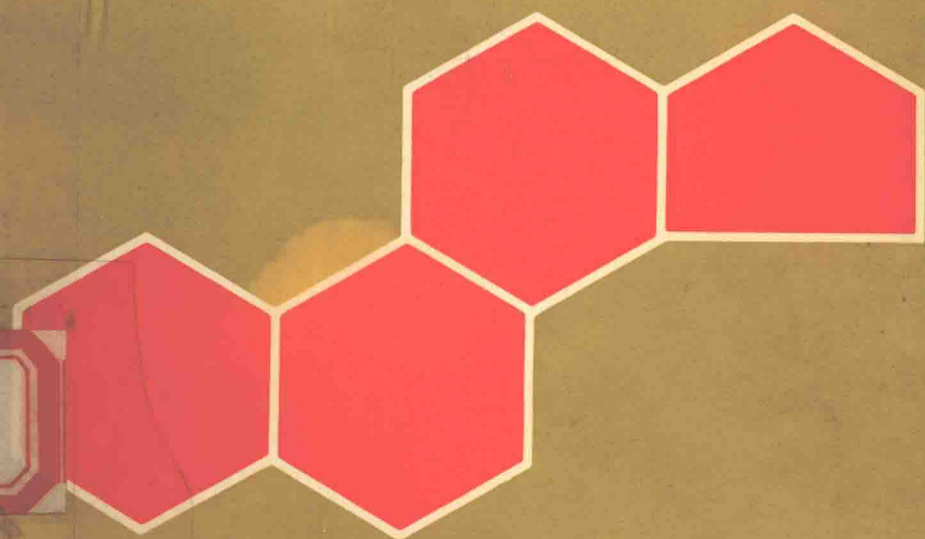


Steroid Hormones

D. B. Gower



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TO DOROTHEA

‘that in all things He might have the preeminence’

Colossians 1:18

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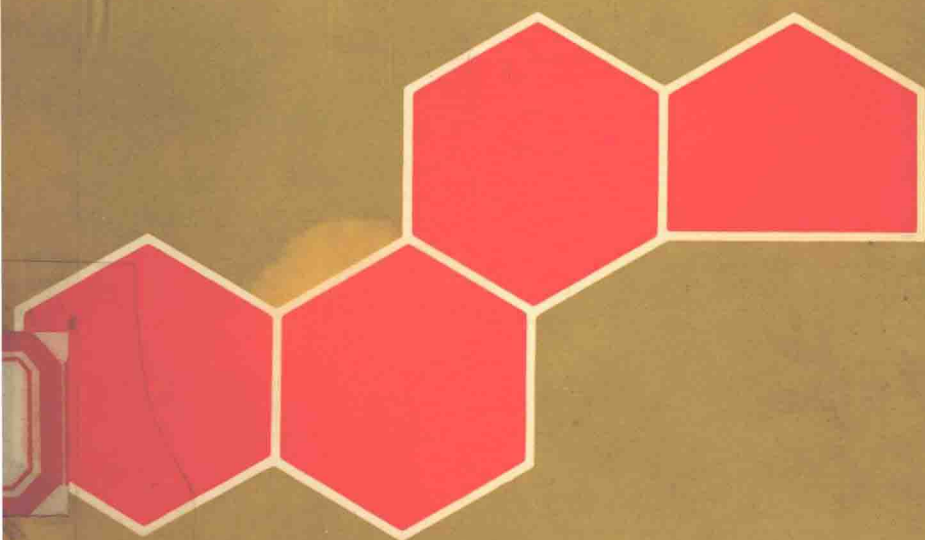
CONTENTS

Preface

1. Structure of Steroid Hormones	11
2. Physiological Actions: Correlation of Structure and Function	19
3. Biosynthesis of Corticosteroids, Androgens and Oestrogens	31
4. Mechanism of Action	45
5. Catabolism and Conjugation	50
6. Occurrence in Human Blood Plasma and Control of Steroid Secretion	60
7. Metabolism in Pregnancy	80
8. Disorders of Steroidogenesis	94
Index	102

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The strength of this book lies in its clarity and in its readability. In my words, it is a 'lay' book, but an approachable lay book. It should be read by chemists, biologists, physiologists and endocrinologists, and by physiologists, biologists, endocrinologists and chemists. It is a book that will be read by the student, the clinician, the researcher and the teacher. It is a book that will be read by the student, the clinician, the researcher and the teacher.

The book is divided into three parts. The first part, chapters 1-4, covers the basic science of steroid hormones, their biosynthesis, their action and their transport. The second part, chapters 5-7, covers the clinical aspects of steroid hormones, including the use of steroid hormones in the treatment of disease and the use of steroid hormones in the treatment of disease. The third part, chapters 8-10, covers the clinical aspects of steroid hormones, including the use of steroid hormones in the treatment of disease and the use of steroid hormones in the treatment of disease. Thus the book will serve equally well for medical and biology students studying basic science as for clinicians in endocrinology, nephrology and gynaecology seeking a handy reference.

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CONTENTS

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STEROID HORMONES

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NEUROTRANSMITTERS AND DRUGS

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PREFACE

This short book on aspects of steroid hormones has stemmed from lectures I give to medical students who take the Basic Medical Sciences course in their first and second years at Guy's Hospital Medical School. The chemical and biochemical aspects are dealt with in the Biochemistry course while the more physiological and endocrinological aspects are pursued in the Human Reproduction and Development course. It was pointed out to me last year that there was no single book in which students could find information on the chemistry, biochemistry, physiology and endocrinology of steroid hormones at the level necessary for the courses they are required to pursue. I welcomed the suggestion that a short book should be written which drew together information from these various disciplines.

It is my experience that some students find the topic of 'steroid hormones' difficult to learn. All too often one hears the cry, 'They all look the same!' Of course this is not surprising, for the compounds are all derived from the same cyclopentanoperhydrophenanthrene nucleus, but it is my hope that, as a result of the way in which the chapters are written and integrated, readers will be able to find a logical sequence in the book and realise the physiological and clinical significance of the steroids.

I am extremely grateful to my wife who has encouraged me throughout the preparation of the work, has typed and retyped the drafts and has helped with the indexing and proof-reading; it is to her that the book is dedicated.

I also express gratitude to Dr H.L.J. Makin of the London Hospital Medical College for making valuable suggestions and criticisms. He is well qualified to do this because he teaches steroid hormone biochemistry during the Basic Medical Sciences course at his own college. Dr G.M. Cooke, a member of my own research group, has kindly given a final, detailed reading to the finished typescript.

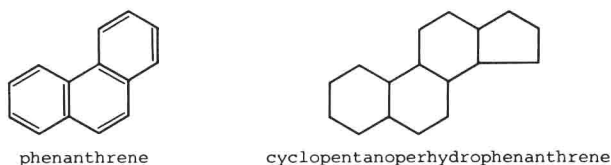
Finally, it is a pleasure to acknowledge the help of the Departments of Medical Illustration and Medical Photography of Guy's Hospital for their unfailing help with the illustrations and photographs. Numerous colleagues and publishers have given permission for me to reproduce figures and data from earlier works, and I am grateful to them all. As always, Miss J. Farmer and the staff of the Wills library have provided invaluable help in obtaining books and locating references.

D.B. Gower April 1979

1 STRUCTURE OF STEROID HORMONES

The parent compound from which all the steroid hormones are ultimately derived is cholesterol. This white, crystalline compound has been known for many centuries and was originally isolated from gall stones; hence the name cholesterol, from *chole*, meaning bile and *sterEOS*, solid. Cholesterol is a constituent of virtually every animal tissue and occurs partly as the free alcohol and partly esterified with the higher fatty acids.

Figure 1.1: Structural Formulae of Phenanthrene and Cyclopentanoperhydrophenanthrene



The basic structure to which all the steroids are related is that of fully reduced phenanthrene (perhydrophenanthrene) to which is fused a five-membered ring structure. The complete structure is shown in Figure 1.1 and is known as the cyclopentanoperhydrophenanthrene nucleus. The parent hydrocarbon related to this, and from which cholesterol is derived, is called cholestane. In addition to the fused four-ring structure shown in Figure 1.2, this compound possesses a side-chain eight carbon atoms long, attached at C-17 of ring D. The numbering sequence, also shown in Figure 1.2, is common to all steroids.

Three-dimensional Structure of Steroids

Neither the full formula nor the abbreviated formula (Figure 1.2) for cholestane can adequately represent its structure because it is a three-dimensional molecule, with length approximately 2 nm, width 0.75 nm and thickness 0.45 nm. Figure 1.3 shows that the cyclohexane rings A, B and C are in the 'chair' form, thereby giving rise to corrugations in the structure and thus contributing to the thickness. The alternative 'boat' structure for cyclohexane rings is less stable and does not

Figure 1.2: Full and Abbreviated Structures of Cholestane

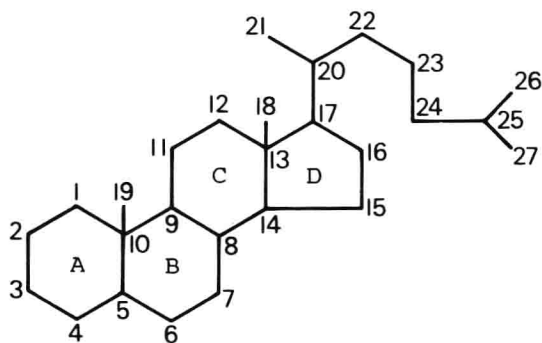
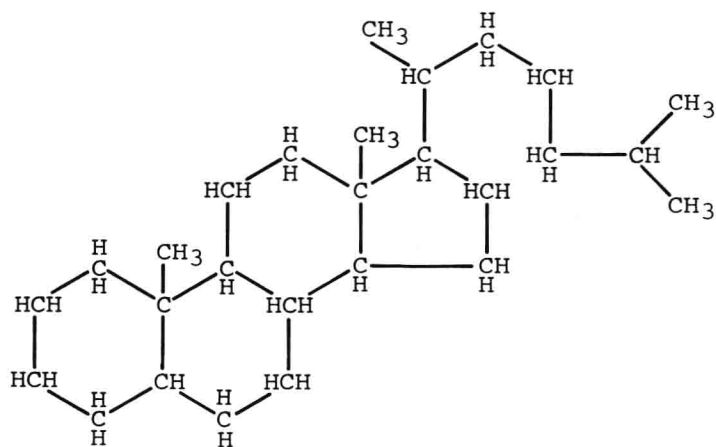


Figure 1.3: Three-dimensional Structures of 5α - and 5β - Cholestane