

SEX HORMONES OF THE FEMALE*

A REVIEW

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SINCE the pioneer work of Berthold (1849) in demonstrating the internal secretory function of the male gonad in regard to the maintenance of secondary "sex stigmata" in birds, great advances have been made in the field of sex physiology. It has been within the last decade, however, that outstanding progress has been made in the development of this special field. It is the purpose of this article to outline, as briefly as possible, the present status of our knowledge concerning the endocrine aspect of this subject as it relates to the female. In a field where theory is so rife, it is essential that one should endeavour to keep theory and facts apart, and in the following paragraphs an earnest attempt has been made in this direction.

The earliest manifestation of endocrine activity of the gonad is found in the young rapidly differentiating and developing embryo. From the earliest elements of the Müllerian and Wolffian duct systems are developed the female and male gonad respectively. The gonad, male or female, as the case may be, proceeds, it is believed, to influence somatic development of the embryo and later of the fetus, so that even at birth certain sex characteristics are well developed. The further development and accentuation of the secondary sex qualities reaching a climax at puberty are so well known and accepted as evidences of gonadal hormone functioning that they may be dismissed at once from this discussion.

A more detailed survey of hormonal factors playing a part in sex physiology of the female may be described under the following heads: (1) the ovary; (2) the pituitary gland; (3) the placenta.

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THE OVARY

Marshall and Jolly,¹¹ as early as 1906, demonstrated that the ovary produces a hormone which causes the phenomenon of oestrus. Subsequent workers — Adler,¹ Iscovesco,⁸ Fellner,⁵ Hermann,⁷ Frank⁶ and others — extended and amplified this observation. Allen and Doisy,² in 1923, developed an accurate method of biological assay of the ovarian hormone of oestrus, best known now as oestrin. They made extracts from pure follicular fluid, and by use of the vaginal smear method were enabled to test their product as they proceeded with its concentration and purification. They found, as did Iscovesco, that the "activity" of ovarian extracts in regard to the production of oestrus in castrated females was associated with the ether soluble or lipid fraction, and with their new method of assay as a guide they were able to produce very concentrated extracts.

Frank, who has worked in the field for a number of years, has recently written a monograph on the "Female sex hormone", by which title he prefers to designate the hormone of oestrus. An excellent review of the literature, both laboratory and clinical, is given in this text. An even more recent monograph by Parkes¹³ covers the subject most exhaustively.

Oestrin has been demonstrated elsewhere than in the ovary. Of chief interest in this connection is its occurrence in the placenta, in amniotic fluid, and in the blood and urine during pregnancy.

The physiological properties of oestrin are best manifested by injecting the hormone into a castrated adult female rat. Forty-eight hours thereafter the animal is found to be in a state of full oestrus as shown by its behaviour towards the male and by the flush of cornified epithelium in the vaginal smear. If the animal is sacrificed