

AGE-DEPENDENT CHANGES IN THE PITUITARY– GONADAL RELATIONSHIP

IV. SEX DIFFERENCE IN RAT PITUITARY FSH CONTENT

A. P. LABHSETWAR

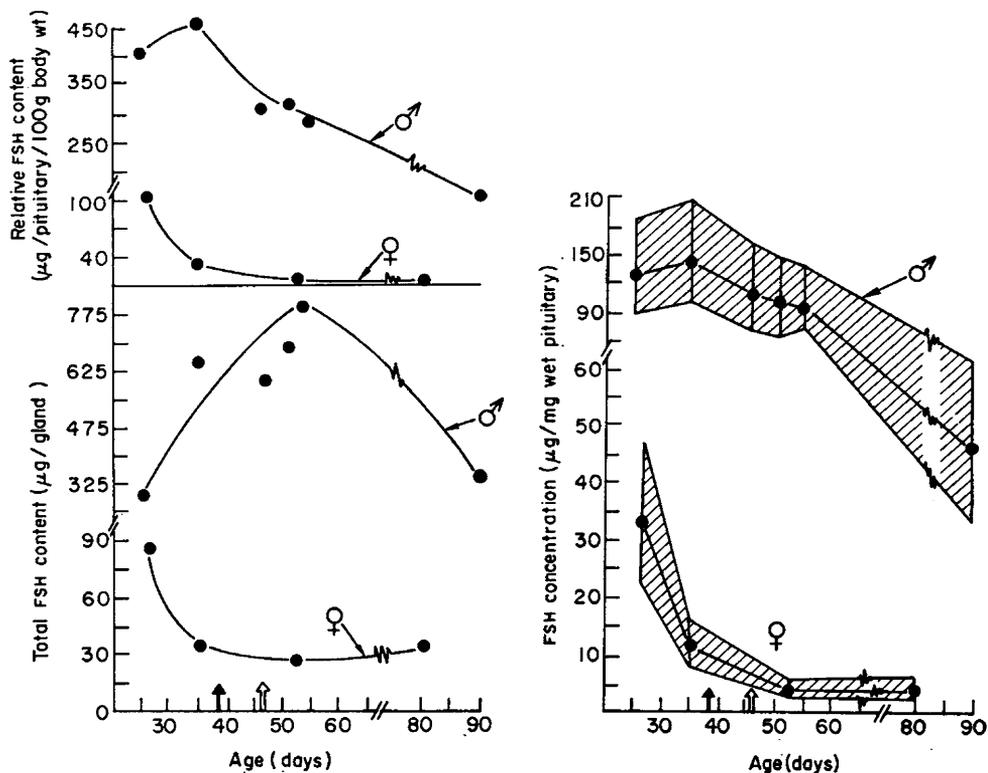
*Imperial Chemical Industries Limited,
Pharmaceuticals Division, Alderley Park, Cheshire*

(Received 18th December 1969)

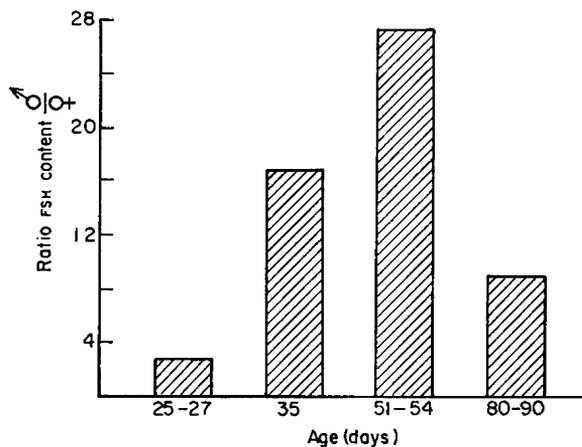
Summary. Pituitary glands from male and female rats, ranging in age from 25 to 90 days, were assayed by the HCG augmentation method of Steelman & Pohley (1953) to determine the sex difference in FSH content. The male gland contained significantly more FSH than that of the female of comparable age throughout the period studied with no evidence for sex reversal during prepubertal to postpubertal development.

Earlier studies using implantation of pituitary glands into immature animals as an assay technique indicated that up to 26 to 28 days of age, the gland of the female rat was more potent in stimulating gonads of recipients than that of the male rat of the same age, whereas, during the postpubertal period, the male gland was more potent (Clark, 1935; McQueen-Williams, 1935). Hoogstra & Paesi (1955), using hypophysectomized recipients, also reported that the FSH content of a month-old female rat pituitary was higher than that of the male rat of a similar age; during the postpubertal period, this sex difference was reversed. More recently, the hypophysial FSH content of female (Kragt & Ganong, 1968a; Labhsetwar, 1969) and male (Kragt & Ganong, 1968b; Labhsetwar, 1970) rats of various ages has been quantitatively measured. These studies, however, do not permit an accurate comparison of sex difference at various ages since this was incidental to and not the primary objective of these investigations. For an accurate comparison, glands from both sexes must be assayed concurrently because of a rather large variation between assays carried out at different times. The results are presented below.

Rats of the Holtzman strain were maintained under standardized conditions of light (14 hr light/10 hr dark) and temperature (71 to 72° F) as described earlier (Labhsetwar, 1969). The rats of both sexes were killed with ether at various ages indicated in Text-figs. 1 and 2. The postpubertal females were killed only when in vaginal di-oestrus in order to minimize variation due to stages of the oestrous cycle. At each age, four to fourteen rats were killed. Their pituitary glands were removed, pooled within each group, weighed and kept frozen (–20° C). At a later date, they were assayed for FSH by the HCG augmentation method of Steelman & Pohley (1953) using either a 2+1 or 2+2 assay



TEXT-FIG. 1. Changes in the pituitary levels of FSH (μg equivalents of NIH-s-4) in male and female rats of various ages. The shaded area in the figure on the right denotes 95% confidence limits. The solid arrow on the abscissa indicates the day of vaginal canalization, while the open arrow refers to the day when spermatid formation was first detected in a proportion of seminiferous tubules.



TEXT-FIG. 2. Variation in the ratio of FSH content ($\mu\text{g}/\text{gland}$) of the male rat to that of the female at various ages.

design (a minimum of four rats/point). The pituitary glands from all age groups of either sex were assayed simultaneously. The assay data were analysed by using the parallel line assay design of Gaddum (1953) as modified by Borth (1960) for multiple assays. The mean index of precision was 0.102.

The results indicate that, at all ages studied, the concentration of FSH ($\mu\text{g}/\text{mg}$) was significantly higher in the male than that in the female pituitary gland. Further, the glands of immature rats of both sexes contained more FSH than those of their adult counterparts (Text-fig. 1) which agrees with our earlier observations (Lahbsetwar, 1969, 1970), but this trend was not found to be significant for male rats by Kragt & Ganong (1968b). The basis for this difference is not known. In agreement with others (see Lahbsetwar, 1969 for references), there was a significant drop in the pituitary FSH before vaginal canalization (Text-fig. 1), though, at this age, the male pituitary did not show any decrease. This occurred much later after the formation of spermatids in a proportion of seminiferous tubules.

The ratio of the total FSH content ($\mu\text{g}/\text{gland}$) of the male to that of the female was always in favour of the male, with no evidence for sex reversal during the period studied (Text-fig. 2). This contrasts with the results of Hoogstra & Paesi (1955) and other earlier workers, who found sex reversal. The magnitude of the ratio varied according to age. The ratio increased to a maximum of about 25 at 51 to 54 days and then dropped to less than 10 by 80 to 90 days of age.

The study was initiated while the author was a member of the Department of Anatomy, Washington University School of Medicine, St. Louis, Missouri, U.S.A., and was supported by grant GB-2476 from the U.S. National Science Foundation, and grant 5RO1 HD 02613 from the National Institutes of Child Health and Human Development. I thank the Endocrine Study Section, National Institutes of Health, for furnishing reference standards and Dr Jewell, Ayerst Laboratories, New York, for liberal supplies of HCG.

REFERENCES

- BORTH, R. (1960) Simplified mathematics for multiple bioassays. *Acta endocr., Copenh.* **35**, 454.
- CLARK, H. M. (1935) A prepubertal reversal of the sex difference in the gonadotrophin hormone content of the pituitary gland of the rat. *Anat. Rec.* **61**, 175.
- GADDUM, J. H. (1953) Simplified mathematics for bioassays. *J. Pharm. Pharmac.* **6**, 345.
- HOOGSTRA, M. J. & PAESI, F. J. A. (1955) A comparison between the FSH and ICSH contents of the hypophysis of adult and immature rats. *Acta physiol. pharmac. nêrl.* **4**, 395.
- KRAGT, C. L. & GANONG, W. F. (1968a) Pituitary FSH in female rats at various ages. *Endocrinology*, **82**, 1241.
- KRAGT, C. L. & GANONG, W. F. (1968b) Pituitary FSH in male rats at various ages. *Proc. Soc. exp. Biol. Med.* **128**, 965.
- LABHSETWAR, A. P. (1969) Age-dependent changes in the pituitary-gonadal relationships. II. A study of pituitary FSH and LH content in the female rat. *J. Reprod. Fert.* **20**, 21.
- LABHSETWAR, A. P. (1970) Age dependent changes in the pituitary-gonadal relationships. III. Changes in pituitary LH and FSH levels in the male rat. *J. Reprod. Fert.* **21**, 407.
- MCQUEEN-WILLIAMS, M. (1935) Sex comparison of gonadotropic content of anterior hypophyses from rats before and after puberty. *Proc. Soc. exp. Biol. Med.* **32**, 1051.
- STEELMAN, S. L. & POHLEY, F. M. (1953) Assay of the follicle stimulating hormone based on the augmentation with human chorionic gonadotropin. *Endocrinology*, **53**, 604.