SHORT COMMUNICATIONS

DYNAMIC CHANGES IN PLASMA ADRENOCORTICOTROPHIN
AFTER NEUROTROPIC STRESS IN MALE AND FEMALE RATS

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(Received 31 May 1977)

Reports of the response of the hypothalamo-hypophysial-adrenal axis to stress have involved measurement of the levels of corticosterone and/or adrenocorticotrophin (ACTH) in the plasma of intact and adrenalectomized rats. It is known that the size and kinetics of the adrenal response are dependent on the nature of the stress and the sex of the rat (Kitay, 1961; Lescoat, Jego, Beraud & Maniey, 1970). From work on the effect of stress on plasma ACTH (Lutz, Koch & Miahle, 1969; Cook, Kendall, Greer, & Kramer 1973; Usategui, Oliver, Vaudry, Lombardi, Rosenberg & Mourre, 1976), the nature of the stress and the parameters of the response appear to be related and Barrett (1960) reported that the release of ACTH in response to stress is greater in female than in male rats. This work describes the kinetics and size of the release of ACTH in male and female rats subjected to mild neurotropic stress.

Male and female 90-day-old Sherman rats, born in the laboratory, were caged in groups of six under conditions of controlled lighting (lights on 07.00–19.00 h) and temperature (23 °C). The animals were then caged singly for 14 h before being subjected to stress: they were placed in a jar in an adjacent room for 3 min and then returned to the animal room. Rats were decapitated between 08.00 and 09.00 h either under basal conditions or at various intervals after the stress. Trunk blood was collected on ice, centrifuged and the plasma used for estimation of corticosterone (Guillemin, Clayton, Lipscomb & Smith, 1959) and ACTH. Isolated adrenal cells were used for the bioassay of ACTH (Sayers, Swallow & Giordano, 1971); plasma samples were acidified with 0·1 vol. 1 M-HCl and assayed against the Third International Working Standard, prepared in rat plasma from which ACTH had been removed by heating for 2 h at 45 °C and pH 7, and subsequent acidification.

The basal concentration of corticosterone in the plasma of male and female rats did not differ and variations in the adrenocortical axis of the female rat due to the oestrous cycle are not considered here. As expected, the concentration of corticosterone after stress was greater in female than in male rats; the difference was significant after 5 min (P<0·05) and reached a peak (female : male ratio, 2·9) 10–15 min after the onset of stress.

The level of ACTH in unstressed rats was undetectable (sensitivity of bioassay, 10 μu. ACTH/ml plasma). Figure 1 shows the stress-induced increase in the levels of ACTH in the plasma of rats of both sexes. In male rats, the peak concentration (27 μu./ml) was reached 5–10 min after the onset of stress, this fell significantly by 15 min (P<0·05, compared with 5 min) and remained constant until 40 min. In female rats, the level increased continuously for 15 min to reach a peak of 61·6 μu./ml and then decreased after 20 min. Levels of ACTH were higher (P<0·05) in female than in male rats 3, 5, 10, 15, 20 and 30 min after the onset of stress.

The female : male ratio for ACTH secretion is 2·8 (total secretion estimated from the areas under the curves); this value does not take into consideration possible differences in the basal rate of ACTH secretion between the sexes.

Release of ACTH is therefore greater and more prolonged in female rats and is concomitant with the secretion of corticosterone, not preceding it, as in the male rat. The results
suggest that the rate-sensitive fast feedback observed in male rats by Jones, Brush & Neame (1972) may be sex-related.

Fig. 1. Changes in the concentration of ACTH (solid symbols) and corticosterone (open symbols) in the plasma of male (squares) and female (circles) rats subjected to a mild neurotropic stress. Values are means ± s.e.m. with six to ten rats in each group.

REFERENCES