COPPEN, A. (1967). The biochemistry of affective disorders. *Br. J. Psychiat.*, **113**, 1237–64.

DONOSO, A. D.. STEFANO, F. J. E., BISCARDI, A. M. & CUKIER, J. (1967). Effects of castration on hypothalamic catecholamines. *Amer. J. Physiol.*, **21**, 737–9.

GREENGRASS, P. M. & TONGE, S. R. (1971). Changes in brain monoamine concentrations during the oestrous cycle in the mouse: possible pharmacological implications. *J. Pharm. Pharmacol.*, **23**, 897–8.

GREENGRASS, P. M. & TONGE, S. R. (1972). Some effects of female sex hormones on monoamine metabolism in the mouse brain. Proceedings of the British Pharmacological Society, March 1972.

LICHTENSTEIGER, W. (1969). Cyclic variations of catecholamine content in hypothalamic nerve cells during the oestrous cycle of the rat, with a concommitant study of the substantia nigra. *J. Pharmacol. exp. Ther.*, **165**, 205–15.

MEYERSON, B. J. (1964). The effect of neuropharmacological agents on hormone activated oestrous behaviour in ovariectomised rats. *Arch. Int. Pharmacodyn. Thér.*, **150**, 4–33.

PAFFENBERGER, R. S. (1961). The picture puzzle of post partum psychoses. *J. chron. Dis.*, **13**, 161–73.

STEFANO, F. J. E. & DONOSO, A. O. (1967). Norepinephrine levels in the rat hypothalamus during the oestrous cycle. *Endocrinology*, **81**, 1405–6.

A theoretical model for antigen aerosol provoked anaphylactic reactions *in vivo*

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When an anaphylactic reaction is provoked in an actively sensitized guinea-pig by exposure to an aerosol of the antigen using the microshock method of Herxheimer (1952), it may be assumed that the antigen gains access via the bronchioles to three tissue compartments containing antibody. The anaphylactic reaction depends upon interactions between antigen molecules (AG) and sessile antibody molecules ($AB_{(s)}$) fixed on an effector organ, to form a complex with an effective configuration AgAb (King & Francis, 1966). If a series of microshock reactions is induced by repeated exposure to the aerosol, by definition each should have the same severity, and it is assumed that each is provoked by a constant concentration of complex (c). Each antigen dose is limited to that sufficient to interact with the antibody in each compartment, such that the constant concentration of complex is formed.

The reaction may be represented by the equation

$$Ag + Ab_{(s)} = Ag\,Ab_{(s)} \text{--------(1)}$$

If relative concentrations are represented by (a) for antigen, (b) for sessile antibody and (c) for complex, and if the completion of the reaction corresponds to an equilibrium

$$K = \frac{c}{(a-c)\,(b-c)} \text{---------(2)}$$

If a series of microshock reactions is provoked by exposures at constant intervals (e.g. 2 h) the required duration of exposure increases progressively, and thus the requisite antigen is increased. This indicates desensitization, and one explanation is that the antibody available for complex formation is progressively depleted.

From equation (2) an expression representing the concentration of antigen reacting in each stage of the series may be derived:

$$a_n = \frac{c}{K}\left(\frac{n}{(b-nc)} - \frac{(n-1)}{(b-c\,(n-1))} + K\right) \text{------(3)}$$

where n=the number of exposures. Values for (a), derived from theoretical con-

siderations may be plotted to reveal linear relationships similar to desensitization curves plotted from experimental data (Hicks, Okpako & Leach, 1968).

An equation giving better agreement with experimental data was

$$a_n = \frac{c}{K}\left(\frac{n}{(b-2nc)^2} - \frac{(n-1)}{[b-2c(n-1)]^2} + K\right)$$

REFERENCES

HERXHEIMER, H. (1952). Repeatable *microshocks* of constant strength in guinea pig anaphylaxis. *J. Physiol., Lond.*, **117**, 251–255.

HICKS, R., OKPAKO, D. T. & LEACH, G. D. H. (1968). Factors determining the development of anaphylactic hypersensitivity in the guinea pig, and their influence on mechanisms involved in desensitization. *Int. Archs Allergy.*, **33**, 29–44.

KING, C. A. & FRANCIS, G. E. (1966). A study on the absorption of antibody by chopped guinea-pig lung and subsequent fixation of antigen. *Immunochemistry*, **3**, 347–358.

Cellulose sulphate, a tool in the evaluation of the plasma kininogen level in the rat

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The plasma kininogen concentration rises with advancing gestation in the pregnant rat; by day 22 of pregnancy the level is approximately twice that found in a normal non-pregnant female (McCormick & Senior, unpublished work). Wiegerhausen, Klausch, Hennighausen & Sosat (1968) found that during parturition in the rat there appeared to be some cleavage of the plasma kininogen. The present study failed to demonstrate a significant fall in plasma kininogen level during parturition; this may be due to a rapid repletion of the kininogen stores. In order to investigate this possibility and in an attempt to elucidate the sudden rise in plasma kininogen concentration during the last few days of gestation, the kininogen depleting agent cellulose sulphate was administered to female rats and the time course of plasma kininogen regeneration was monitored.

Cellulose sulphate was prepared using the method of Astrup, Galsmer & Volkert (1944); a dose of 1 mg/kg dissolved in physiological saline was injected into the femoral vein of ether anaesthetized female rats of the C.S.E. strain. Using the micromethod of Diniz & Carvalho (1963) the plasma kininogen concentration was determined in blood samples taken at various time intervals following the injection of the sulphopolysaccharide.

Three groups of animals were used, non-pregnant rats in oestrus and dioestrus and 22 day pregnant rats. Twenty min after the injection of cellulose sulphate there was a significant fall in the plasma kininogen content in all three groups. This low level was maintained for 40 min and was followed by a gradual repletion of the plasma kininogen stores. Full repletion was obtained within 10 h following drug administration.

About 3 h after the injection of cellulose sulphate there appeared to be an interruption in the repletion of the plasma kininogen stores followed by a partial depletion. In dioestrus and 22 day pregnant rats this secondary depletion was