An Electronic Animal Activity Recorder

Several methods have been described which will detect and record the general activity of animals. STEWART[1] used a revolving drum as early as 1898. SZYMANSKI[2] described a method in which a cage was mounted upon tambours; pressure changes at the tambour were detected and displayed on a kymograph. Most methods have been variants of these and have been criticized on the grounds that special cages are needed, the nesting habits of the animal may bias the cage, the instability of the cage may alter the behaviour of the caged animal, and comparison of the activities of caged animals is unreliable. LACEY[3] has claimed that unless practically identical cages are used differences in activity may be no more than differences in the characteristics of the cage.

One of us (P.L.C.) has been interested in the recording of activity patterns as part of a study of the effects of ingested toxic materials in the rat. Many problems attend the interpretation of the growth rate of animals during toxicity trials. The diet may be unpalatable and thereby restrict the dietary intake; the compound may change the metabolic rate of the animal; or the general activity of the animal may change. The method described in this paper, which has already been briefly described by CHAMBERS[4], was devised in an attempt to monitor this variant.

The introduction of the plastic rat cage into the laboratory has made the task of electronic detection much easier. Initially it was suggested that 'stick-on' plates could be used as proximity detectors and that the rat at earth potential on approaching the detector would form a capacitor system. The plastic of the cage would act as the dielectric. It was doubtful whether such a system would be sufficiently sensitive so a system using a transmitter and tuned detectors has been used, still using the 'stick-on' plates, but as antennae on the outside of the cage (Figure 1).

The method makes use of the magnetic field about a source of electric current and the capacitance of two adjacent bodies.

The plastic cage (Figure 1) has metal grilles at the top and bottom. Both grilles receive an electrical signal from an oscillator as a sine wave of 80 kc/sec and 2 V peak to peak (Figure 2). The rat in contact with the grille becomes an extension of the transmit area. The receiving antennae are fixed by suckers to the ends of the cage.

1 C. C. STEWART, Am. J. Physiol. *1*, 40 (1898).
2 J. S. SZYMANSKI, Arch. ges. Physiol. *158*, 343 (1914).
3 O. L. LACEY, Am. J. Psychol. *57*, 412 (1944).
4 P. L. CHAMBERS, U.F.A.W. Symposium on Cage Design 1963, J. Animal Tech. Ass. *16*, 21 (1965).

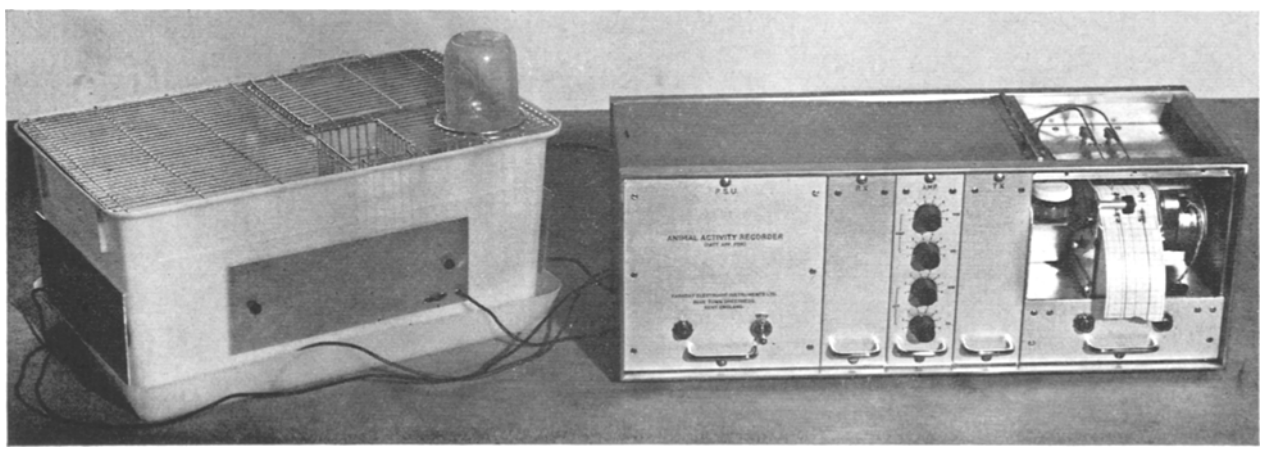

Fig. 1. Apparatus for the detection of animal activity.

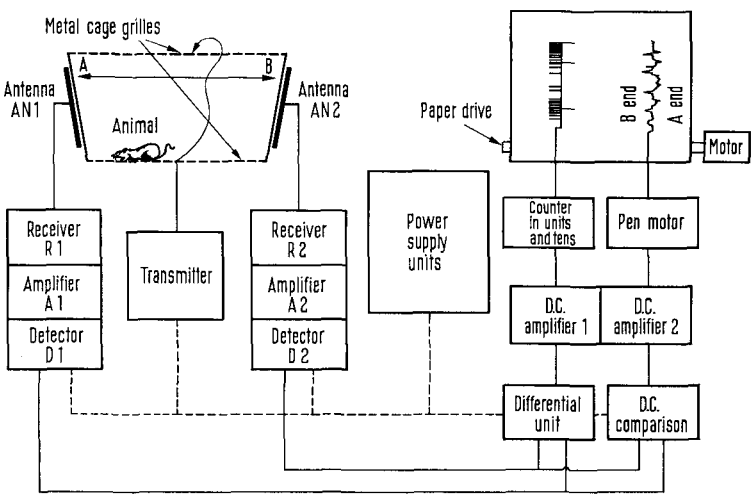

Fig. 2. A schematic circuit diagram of the animal activity recorder.

The signals received at the antennae are fed to tuned receivers (R_1), (R_2) and are amplified at the amplifiers (A_1), (A_2). The detectors (D_1), (D_2) rectify the signal to a DC potential. The sine wave is detected in opposite polarity on the opposing antennae AN1 and AN2. With the cage empty the DC voltages fed from the detectors are set equal. Since these signals are of opposite polarity the result of comparing the DC levels at the DC comparison unit will be zero.

When the rat is introduced into the system, an imbalance of the signal strength is produced which is dependent upon the position of the rat relative to the two opposing antennae. The strength and sign of the detected voltages vary and are at zero only when the rat is central between the two antennae.

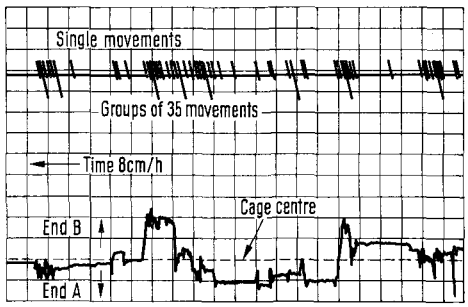

Fig. 3. A recording of the quantitative activity and positional movement of the rat.

The information derived by this method may be displayed on calibrated chart paper as a line indicating the position of the animal between the antennae with respect to time. An alternative method, however, also shown in Figure 2, is to measure the rate at which the signal strengths change. The change in incoming signal is differentiated in the differential unit and the activity is displayed quantitatively as a series of pulses with respect to time. A typical recording is presented in Figure 3.

At high amplification with the animals at rest, movement of the chest wall in respiration can be detected. Work is continuing to apply this method for the detection of unrestrained respiratory rate.

Résumé. On décrit une méthode pour discerner et enregistrer l'activité générale des animaux de petite taille, logés dans des cages en matière plastique, en employant un transmetteur et des antennes accordées. Le système utilise les caractéristiques du champ magnétique autour d'une source de courant électrique et la capacité de résistance des objets contigus.

P. L. CHAMBERS[5] and T. J. SALMONS

'Shell' Research Ltd., Tunstall Laboratory, Sittingbourne (Kent) and Faraday Electronic Instruments Ltd., Sheerness (England), July 27, 1965.

[5] Present address: Department of Pharmacology, Trinity College, Dublin (Ireland).

CONGRESSUS

Schweiz

2. Euchem-Konferenz über Stereochemie

Bürgenstock bei Luzern (Schweiz) 8.–14. Mai 1966

Nur eine beschränkte Zahl von Teilnehmern können zugelassen werden.

Kongressauskunft. Prof. Dr. D. ARIGONI, Organisch-chemisches Laboratorium der ETH, Universitätsstrasse 6, 8006 Zürich (Schweiz).

Ciba Ltd. and University of Basel (Switzerland)

Argentina

VII° Congreso de la Asociación latino americana de giencias fisiológicas

Mar del Plata, August 7–12, 1966

The Congress will be organized for Free Communications, Special Lectures and Symposia on leading topics in Physiology, Biochemistry and Cellular Biology. The Special Lectures and Symposia will be scheduled with the participation of leading Latin American personalities in each field.

The deadline for reception of registration forms and abstracts of Free Communications will be February 1st, 1966. Subscription Fees are: US$ 15.– for Titular Members and US$ 10.– for Associate Members.

The information booklet and registration forms may be obtained on request from the Office of the VII° Congress of the A.L.A.C.F., Paraguay 2155, 7° piso, Buenos Aires (Argentina).

Please note that the official languages of the Congress will be Spanish, Portuguese and French.