TECHNICAL NOTE

AUTOMATIC MONITORING OF
APOMORPHINE-INDUCED PECKING IN PIGEONS¹

Compulsive pecking in pigeons, provoked by apomorphine and related drugs, was first described by Amsler in 1923 and has since been the subject of considerable interest to pharmacologists as a model of drug-induced stereotypical behavior. The apomorphine response is best characterized by a single symptom: a continuous, forceful, repetitive pecking by the pigeon on the floor, walls, and roof of the cage in which it is placed.

Although various parameters of response have been quantified (Burkman, 1960; Dhawan and Saxena, 1960), the total number of pecks during the period of drug action (cumulative pecks) has proved to be the most useful attribute, insofar as it represents a reliable measure of dose-dependent response intensity. Assays have been successfully developed for assessing the relative potencies of psycholeptic phenothiazines that require reliable measurements of cumulative pecks (Burkman, 1962; Turner, 1965). The efficiency with which these assays were conducted was greatly facilitated by the use of an electromechanical instrument that automatically monitored the desired response. Since the instrument will register and accumulate pecks that originate from anywhere in the testing cage it may have wider applicability in behavioral research (e.g., detecting missed-key pecks).

The design of the electromechanical monitor was based upon the results of preliminary efforts to adapt an audio pickup system for continuously recording the sharp microphonically distinct clicks of the bird's beak as it struck a metal cage. The sounds that accompanied the compulsive pecking behavior provided a quantifiable variable that readily lent itself to machine processing.

To monitor effectively apomorphine-induced pecking, each channel of the system required: (a) a sensitive detector to pick up and transmit signals generated by sounds or vibrations developed as a result of the bird's pecking movements, (b) a means for suitably amplifying the detector signal so that, (c) an electro-mechanical relay and impulse counter could be activated by each discrete pulse. Also essential was the incorporation of means for improving the instrument's capacity for dis-

criminating between pecking activity and fortuitous noises and movements unrelated to pecking.

The monitor design adopted for use is diagrammed in Fig. 1 (see over page). The use of a simple contact microphone, bolted to the rear panel of a stainless steel observation cage 9 by 15 by 9 in. high (22.9 by 38.1 by 22.9 cm) served as the transducer. Environmental noises, bird vocalizations, and other air-transmitted sounds were incapable of activating the microphone. The unit was, however, sufficiently sensitive to pick up virtually all desired responses. Signals generated by the microphone were transmitted to a solid-state audio preamplifier and audio amplifier. A Schmitt trigger, incorporated in the system, is a modified bistable multivibrator that is widely used as a voltage discriminator in such devices as nuclear radiation pulse height analyzers. It served much the same function here. Input signals above a present level provided an output signal always sufficient to activate the relay that in turn operated the impulse counter. This insured that clean, artifact-free counts could be obtained. A 12- and 30-v dc regulated power supply provided the energy necessary for operation.

A six-channel unit has been in use for approximately 2 yr and, during that time, has functioned effectively and efficiently as an attendant-free assay instrument.

REFERENCES

- Amsler, C. Beitrage zur Pharmakologie des Gehirns. *Naunyn-Schmiedeberg's Archiv für Experimentelle Pathologie und Pharmakologie*, 1923, 97, 1-14.
- Burkman, A. M. Note on the characteristics of an apomorphine response in pigeons. *Journal of the American Pharmaceutical Association, Scientific Edition*, 1960, 49, 558-559.
- Burkman, A. M. Potent anti-apomorphine action of fluphenazine in pigeons. *Archives Internationales de Pharmacodynamie et de Therapie*, 1962, 137, 396-403.
- Dhawan, B. N. and Saxena, P. N. Apomorphine-induced pecking in pigeons. *British Journal of Pharmacology*, 1960, 15, 285-289.
- Turner, R. A. *Screening methods in pharmacology*. New York: Academic Press, 1965. Pp. 235-237.

¹This investigation was supported by Grant MH 11733-01 from the National Institute of Mental Health, U.S. Public Health Service. Reprints may be obtained from the author, Division of Pharmacology, College of Pharmacy, The Ohio State University, Columbus, Ohio 43210.

A. M. Burkman
The Ohio State University

Fig. 1. Circuit diagram of one channel of the pecking syndrome monitor.