ANTAGONISM OF A BEHAVIORAL EFFECT OF *d*-AMPHETAMINE BY CHLORPROMAZINE IN THE PIGEON¹

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A dose of *d*-amphetamine which completely suppressed all responding was administered to each of five pigeons under an FR 30 schedule. When the pigeons were treated with chlorpromazine after 45 min or more, responding was restored. When *d*-amphetamine and chlorpromazine were administered simultaneously to three other pigeons, responding was better maintained than after *d*-amphetamine alone. This study confirms a previous finding that chlorpromazine can antagonize the rate-decreasing effect of *d*-amphetamine.

Antagonisms between the rate-increasing effect of amphetamine and the rate-decreasing effect of chlorpromazine have been reported. Brown (1963) showed in the rat that the rate-decreasing effects of high doses of *d*-amphetamine could be antagonized by chlorpromazine. This study confirms this finding in the pigeon.

METHOD

Eight mature male pigeons, previously trained under several different reinforcement schedules, were maintained at 80% of free-feeding weights and studied in a standard experimental chamber (Ferster and Skinner, 1957).

Daily sessions were given on an FR 30 schedule of reinforcement. The reinforcer was access to a grain mixture for 2.5 sec. Sessions terminated after 100 reinforcements. The response key was transilluminated by a red light, and a white light illuminated the interior of the box except during reinforcement.

Drug studies were begun when performances appeared stable. Doses of *d*-amphetamine SO₄ and chlorpromazine HCL are specified in terms of the salts. Drugs were dissolved in 0.9% saline; the total drug dose never exceeded 0.5 ml. All injections were given into

the breast muscle. *d*-Amphetamine was administered before the session, and the subjects returned to their home cages for 15 min before being placed in the apparatus.

Exploratory experiments determined a dose of *d*-amphetamine that would prevent responding and yet could be antagonized by chlorpromazine. Doses differed slightly among individual subjects but were usually about 6 mg/kg of *d*-amphetamine (see Fig. 2). With the selected dose most subjects responded only a few times over a period of 2 hr.

In five subjects (Group 1) chlorpromazine was administered during the session between 45 and 105 min after the *d*-amphetamine. At least three times during the study, each subject was removed from the apparatus and given saline rather than chlorpromazine; after being returned to the apparatus for a suitable interval, it was removed once again for the chlorpromazine injection.

In three subjects (Group 2), chlorpromazine and *d*-amphetamine were administered simultaneously 15 min before the session. The *d*-amphetamine injection was followed as quickly as possible by the injection of chlorpromazine on the opposite side of the subject's breast.

Various dosages of chlorpromazine in the range 1 mg/kg-30 mg/kg were tried with both groups.

RESULTS AND DISCUSSION

Figure 1 shows the effects of successive injections of saline and chlorpromazine in Group 1.

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Fig. 1. Cumulative response records showing chlorpromazine antagonism of abolition of responding by *d*-amphetamine. Pips on the record indicate food deliveries. The recording pen reset to the bottom of the record when 1100 responses had cumulated. *d*-Amphetamine, 6 mg/kg, was injected 15 min before the session. The injection of saline had no effect; the injection of chlorpromazine restored responding within 5 min.

Saline was ineffective, but 10 mg/kg of chlorpromazine antagonized the abolition of responding produced by 6 mg/kg of *d*-amphetamine. As Fig. 2 demonstrates, the restored performance was virtually identical to the normal FR. Figure 2 shows individual records for birds of this series.

For Bird 1869, the antagonism could be obtained twice during a single session. The subject failed to respond after *d*-amphetamine was administered, did respond after 10 mg/kg of chlorpromazine, and stopped responding after a second dose of *d*-amphetamine.

In Group 2, chlorpromazine again antago-

Fig. 2. Cumulative response records showing control performance under FR 30 (record A) and chlorpromazine antagonism of abolition of responding by *d*-amphetamine in several birds (Records B, C, D, E, and F). Pips on the record indicate food deliveries. The recording pen reset to the bottom of the record when 1100 responses had cumulated. The first 30 min, during which no responses occurred, have been omitted.

Fig. 3. Cumulative response records showing effects of 6 mg/kg of *d*-amphetamine (15 min before session) on responding under FR 30 (Record A) and effects of simultaneous administration of chlorpromazine 15 min before the session (Records B, C, and D). Pips on the record indicate food deliveries. The recording pen reset to the bottom of the record when 1100 responses had cumulated. Effects of 10 mg/kg of chlorpromazine (Record B; Record C). Record D: effect of 3 mg/kg of chlorpromazine.

nized the abolition of responding by *d*-amphetamine.

The results of varying dosages were the same in both groups. Chlorpromazine, 10 mg/kg, was as effective as 30 mg/kg. It is of interest that Waller and Morse (1963) have demonstrated that chlorpromazine alone, in the dose range between 3 mg/kg and 30 mg/kg, does not increase the rate of responding on FR 30.

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