Para-Chlorophenylalanine:
Its Effects on Auditory Discrimination

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Abstract. The effects of Para-chlorophenylalanine (P-CPA) on the discrimination of a low intensity tone were evaluated. Three rats were trained in a two-lever operant chamber to press the right lever to terminate a tone and to press the left lever when the tone was off for food reinforcement. Errors, consisting of left-lever responses when the tone was on or right-lever responses when the tone was off, were recorded and used to determine the percent of the total responses that were correct.

After training to essentially errorless performance, the tone intensity was lowered until the rats were performing at about 75% correct responses. After each rat achieved a stability criterion, it was treated P. O. with 150 mg/kg of P-CPA in mineral oil or with mineral oil alone. Each rat received P-CPA at least twice and mineral oil alone at least once. P-CPA consistently elevated the percent of correct responses while depressing the over-all response rate. Mineral oil had no effect on either measure.

Key words: Para-Chlorophenylalanine — Auditory Discrimination — Serotonin — Sensitivity.

Many studies of the functions of brain serotonin have analyzed the behavior of adult animals following treatment with para-chlorophenylalanine (P-CPA), a specific depletor of serotonin (Koe and Weissman, 1966). P-CPA produces hypersexuality (Tagliamonte et al., 1969) and insomnia (Jouvet, 1969), and facilitates the performance of brightness discriminations (Stevens et al., 1967; Stevens, 1970) and shock avoidance (Tenen, 1967; Schlesinger et al., 1968; Brody, 1970). In these situations, drug-induced motivational changes may mediate the observed facilitation of performance. In the brightness discrimination studies, the rats were either water deprived and rewarded with water (Stevens et al., 1967) or water satiated and rewarded with saccharin (Stevens, 1970). P-CPA has been shown to increase water intake (Brody, 1969) and to increase the intake of low concentrations of sucrose (Nance et al., 1971) so that brightness discrimination performance facilitation in the previous

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studies could be due to a drug-induced increase in the incentive value of the liquid rewards. The facilitation of shock avoidance is probably due to the increase in sensitivity to foot shock of rat subjects that results from P-CPA treatment (Tenen, 1967).

The report that P-CPA increases sensitivity to shock is consistent with the casual observation that rats having central serotonin depletion due to raphe lesions seemed to be “hypsersensitive” to clicks and touching (Kostowski et al., 1968). Another observation, that rats depleted of serotonin with P-CPA were more active in an environment rich with auditory and visual stimulation, was interpreted as an increase in “reactivity” following serotonin depletion (Brody, 1970). The hypersexuality and insomnia observed in P-CPA-treated animals might also be due to an increase in sensitivity of the subjects to low intensity stimuli which are usually ineffective in eliciting sexual or general arousal.

If P-CPA does produce a general increase in the “reactivity” or “sensitivity” of rats to low intensity stimuli, one would expect the drug to produce an improvement in performance at a task in which rats use the onset and offset of a low intensity stimulus to obtain food. To test this hypothesis, Blough’s technique (Blough, 1958) for measuring visual sensitivity of pigeons was modified to assess auditory discrimination of a low intensity tone by rats before and after P-CPA intubation. Previous findings indicate that P-CPA does not increase food motivation as measured by running times in a maze to food reward, nor does it increase food intake (McFarlain, 1972). The use of a food reward in this study avoids the possibility that drug-induced performance facilitation is due to motivational effects of the drug.

Methods

Three Long Evans hooded rats were maintained at 70% of their at libitum body weights and were trained to barpress for food in a two lever operant chamber. Mounted on top of the chamber was a speaker through which an 8 KHz pure tone generated by a Maico audiometer could be delivered.

In this task, each rat was reinforced with food for responding on the left lever until a response requirement was reached, but only if the 8 KHz tone was off. If the tone was on, the rat could not be reinforced. However, if the tone was on, the rat could terminate it by responding on the right lever until a response requirement was met. The number of responses required on the left lever to obtain food and on the right lever to terminate the tone varied continuously between four and fifteen responses with an average of eight responses to complete the requirement (variable ratio 8 schedule). The variable ratio circuitry allowed a reset to a count of zero if the rat responded prematurely on the incorrect lever, insuring that alternation of responses from the correct to the incorrect lever, then to the correct lever would never be rewarded.

Beginning immediately after each termination of the tone with right-lever responses, there was a 0.5 sec period during which any additional right-lever