1978 Poultry Science 57, 821-822

More Persistence during Task Acquisition by Intact *Vs.* Castrated Japanese Quail

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(Received for publication November 29, 1977)

ABSTRACT Data from 13 castrated and 12 intact food-deprived Japanese quail show that there is a very similar rate of acquisition of a simple T-maze color discrimination. In the same apparatus, the number of error pecks varies on a match to sample brightness discrimination. The relatively stable performance and longer response sequences of intact and the more erratic performance of castrated birds is interpreted as showing that circulating androgens are important in the formation of a stable pattern of response in adult birds. These results support work showing that central specifications for a task, once established, persist longer under the influence of circulating androgens.

INTRODUCTION

There are few reports of the influence of physiological factors on the methods used by animals in task solution (Broverman *et al.*, 1964; Klaiber *et al.*, 1971; Andrew and Rogers, 1972; Oades, 1976). The influence of testosterone has been investigated with *Gallus* chicks that have been trained to prefer red food grains to yellow (Andrew and Rogers, 1972). On a pebble-encrusted floor where both foods were available, chicks that had been injected with testosterone showed longer runs of pecks on red food than oil-injected controls. Andrew and Rogers claim that once the central specifications for a trained color preference are established, testosterone-injected birds retain the preference longer than controls.

Broverman *et al.* (1964) report that androgens facilitate the retrieval of an acquired set of specifications in man. Young male subjects with high androgen levels performed well on a task involving the recognition of repeated objects, but they did not differ from the mean of the group on a test involving the naming of non-repeated objects. The first task requires a limited set of specifications; the latter requires that the specifications for recognition be continually changed.

In this study intact and castrated Japanese quail (*Coturnix coturnix japonica*) were presented with a complex match to sample discrimination where they could enter the correct arm in a T-maze by pecking the door in the arm that had a similar brightness to one at the end of the runway. Circulating androgens should not facilitate acquisition of this task because the central set of specifications changed from trial to trial, analogous to the task of naming non-repeated objects. But the availability of several strategies for response presented the opportunity for individual subjects with circulating androgens to persist with one type.

MATERIALS AND METHODS

Twenty five male Japanese quail aged from 8–12 months were maintained on a 12-hr light cycle at 80% of normal body weight in four groups. There were 6 castrates with experience (Ed) and 7 without experience (InEd) of a simple T-maze discrimination and 4 sham-operates with experience (Ed) and 8 without experience (InEd) of a simple discrimination. The testes were removed through a lateral cut in the abdomen. Sham-operation consisted of the cut alone.

After three weeks to allow physical recovery and loss of circulating hormones, all birds were given 10 min pretraining experience in the T-maze for 5 days. Intact and castrated birds showed the same rate of acquisition of the simple color discrimination (zero errors after 50–60 trials).

In the complex discrimination, door B (Fig. 1a) could be either black or white. After a peck

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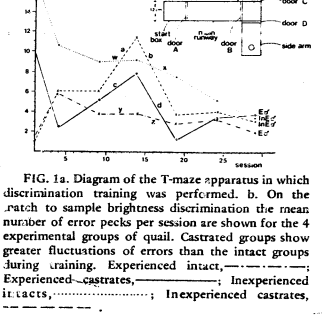

FIG. 1a. Diagram of the T-maze apparatus in which discrimination training was performed. b. On the patch to sample brightness discrimination the mean number of error pecks per session are shown for the 4 experimental groups of quail. Castrated groups show greater fluctuations of errors than the intact groups during training. Experienced intact, —·—·—·—; Experienced castrates, ————; Inexperienced intacts, ·····; Inexperienced castrates, – – – – – .

it was raised to allow access to C and D (one black, the other white). If B was white, there was food behind the second white door. If B was black, there was food behind the second black door. The sequence black/white on B and the position of black/white on C/D was random. Pecks to the incorrect door were scored as errors and the door remained closed. The one training session each day was terminated after 5 correct trials or after 5 min if this criterion was not reached. Feeding was allowed for 10 sec. The intertrial interval was 30 secs.

RESULTS AND DISCUSSION

Castrated experienced birds scored more errors than intact experienced birds on the first session ($P<.03$ Mann Whitney U test, Siegel, 1956), but with few birds consistently responding at first, no significant intergroup comparisons occurred before session 9. From session 9 castrates significantly increased (a, $P<.016$; c, $P<.03$, Fig. 1b) then decreased their error scores (b, $P<.06$; d, $P<.03$ – Sign test, power efficiency 95%). No significant changes were shown by intacts (w, x, y, and z, Fig. 1b). Over this period experienced birds made fewer errors than the inexperienced birds ($P<.05$, Fischer Tes., Siegel, 1956).

To see if the less variable error scores reflected a persistent pattern of responding, two types of response sequence were examined (Krechevsky, 1935). A position sequence consisted of three or more consecutive responses to the left or right door provided that it was both black and white during the three trials. A brightness sequence consisted of three or more consecutive responses to the black or white door provided that it was located in both arms during the three trials.

The number of responses during a brightness or position sequence was 20% higher for intacts than for castrates. All birds showed longer sequences to position than to brightness (longest response sequence, $P<.002$, Mann Whitney). Sequences were longer for intact than for castrated birds ($P<.047$, Mann Whitney). The mean lengths for brightness and position sequences, respectively, were 4.8 and 6.6 pecks for castrates and 5.0 and 8.6 for intacts. There were no significant differences between the response lengths of experienced and inexperienced birds.

The response patterns suggested by the error scores (low for experienced and stable for intact birds, Fig. 1b) and the longer response sequences for intact birds support the work of Andrew and Rogers (1972) and Broverman *et al.* (1964). They suggest that once established the central specifications for a given response pattern, whether acquired through experience of a similar task or through new learning, persist for birds with circulating androgens.

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