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BRIEF REPORT

Effects of Isolation and Grouping on Guinea Pigs

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Guinea pigs spent 80 days in isolation or same-sex groups beginning either immediately after weaning or in adulthood. Isolated animals were more active in a cross maze, but not in an open field. No group of animals preferred a goal guinea pig in a four-choice test. Males isolated at weaning meeting another such male were more aggressive than males in isolated-grouped or grouped-grouped encounters, but did not make more nonaggressive contacts. Males isolated in adulthood meeting other such males exhibited more nonaggressive behavior, but not more fighting. Use of "gregariousness" as a unitary concept is questioned.

A number of studies have assessed the effects of isolation vs group rearing on social and reproductive behavior in guinea pigs. Isolation appears to be more disruptive of mating behavior the earlier it is initiated (Gerall, 1963). However, when only social approach behavior was tested, Nagy and Misanin (1970) found that age at onset of isolation (between 0 and 30 days) did not differentiate among their isolated animals. They found that group reared guinea pigs spent approximately half their time in an alley runway near another guinea pig, while isolated guinea pigs spent only about 30% of their time there. On the other hand, Harper (1968) found that guinea pigs isolated at birth made more contacts with a normally reared test animal than did socially reared animals. One reason for the apparently contradictory findings may be that in Nagy and Misanin's study the stimulus animal was separated from the experimental animal by Plexiglas, which eliminated olfaction, an important social cue. In addition, activity of the stimulus animal seems to be an important variable. Nagy and Misanin reported that their stimulus animal remained relatively immobile, whereas Harper's stimulus animal was fully accessible and responsive to the experimental animal.

There are several factors which might influence an animal's approach to a goal animal, including curiosity, playfulness, aggressiveness, and sexual interest. A conspecific goal animal would present greater novelty to an animal which had had little or no experience with conspecifics. Furthermore, a number of studies have shown that animals kept in an environment with little

change show more exploratory behavior and work to produce more stimulus change than animals kept in a stimulus-rich environment (Glanzer, 1953; Premack, Collier, & Roberts, 1957; Robinson, 1957). Furthermore, since isolation is known to facilitate aggression in mice and, often, rats, some of the approaches made by the isolates may be related to aggressive tendencies.

This study investigated effects of early, as opposed to adult, isolation and grouping. Open field and social interaction behavior were observed. Relative adrenal weights were measured as a sign of stress reaction; body and testis weights were also recorded. Guinea pigs were chosen in order to resolve the discrepancy between the results of Harper and Nagy and Misanin and to determine whether early isolation in guinea pigs produces effects on social behavior which are not replicated when isolation occurs in adulthood.

Subjects for Expt I were 34 pigmented guinea pigs, obtained at weaning (21 days) from Marland Breeding Farms. (Of 60 animals originally obtained, 26 died within 30 days.) Upon arrival they were randomly divided into same-sex groups of 1, 4, or 8 animals. After 30 days, there were 3 groups of 5 males each, 3 groups of 3 females each, 6 isolated males, and 4 isolated females. Testing began at 100 days of age; all animals appeared to be healthy. Twelve adult males were later obtained and kept in isolation or groups of 3 for 80 days before testing.

The cross maze has been described elsewhere (Hull, Langan, & Rosselli, in press). Briefly, it consisted of four arms, at the ends of which were four chambers, separated from the arms by screen wire. One chamber contained a guinea pig of the same sex as the experimental animal; another, a white mouse; the third, a jar of clean sawdust; and the fourth, two shelled walnuts. The 1 m^2 open field was painted gray, with 16 equal squares lined off on the floor.

All animals in Expt I were first tested in the cross maze and then individually in the open field. Then isolated and grouped males were paired with other males in the open field for the social interaction test. One week elapsed between tests for each animal. The experimental room was dark except for a 40 W bulb 60 cm above the apparatus. The apparatus was cleaned after each trial with a dilute alcohol solution. Experiment II animals were tested first individually in the open field and then with another male in the social interaction test. All tests lasted for 10 min.

Cross maze tests began by placing an animal into the center of the cross facing one of the arms; direction of placement was rotated. A choice was recorded every time the animal touched the wire with either face or forepaws or moved to a new location on the screen. Open field tests consisted of placing an animal into the center of the field and recording number of lines crossed with all four feet and number of boluses deposited. Each male was tested twice for social interaction, once with another male from his own density condition (but different cage) and once with a male from the other

condition. Order of confrontation was counterbalanced. Each time an animal initiated fighting, sniffing, or bodily contact, the appropriate score was recorded.

Analysis of variance showed that isolated animals made more choices in the cross maze than did grouped animals ($P < .01$). (See Table 1) There were no sex or density differences in percentage of choices within each arm. However, between-arm percentage comparisons showed that the arm containing the mouse was chosen more than those containing the food ($P < .01$), the sawdust ($P < .01$), and the guinea pig ($P < .05$). Isolated animals also made more contacts than did grouped animals ($P < .01$). The screens in front of the mouse and the guinea pig were contacted more than that in front of the sawdust ($P < .001$, $P < .05$). No other between-arm comparisons showed statistical differences.

There were no significant differences in activity or defecation in the open field in either experiment. Average lines crossed were 48; average boluses were .42. Approximately half the animals in all groups froze for 4 min or longer, and five animals froze for 10 min.

Analysis of variance for social interaction measures of Expt I indicated significant differences only for fighting ($P < .01$). (See Table 2.) In Expt II only the sniff and contact measure showed a significant difference ($P < .01$).

The only significant physiological difference in either experiment was heavier adrenals of females compared with males in Expt I. There were no significant differences in body weight, testis weight, or other significant differences in adrenal weight due to grouping or isolation in either experiment.

The significantly greater exploratory activity (number of choices) of isolated animals in the cross maze of Expt I was not obtained in the open

TABLE 1

Choices and Contacts in Cross Maze

		Total (av.)	% A (sawdust)	% B (mouse)	% C (walnuts)	% D (guinea pig)
Iso. male	Choices	13	13	40	28	19
	Contacts	10	8	36	12	44
Grp. male	Choices	9	18	41	15	26
	Contacts.	6	9	24	26	41
Iso. female	Choices	26	27	37	17	19
	Contacts	18	26	57	13	4
Grp. female	Choices	4	10	44	14	32
	Contacts	3	0	53	37	10

TABLE 2

Average Social Interaction Scores[a]: Experiments I + II

		Iso-Iso	Iso-Grp	Grp-Grp
Aggressive actions	Expt I	11.7	3.3	0
	Expt II	.7	.1	0
Nonaggressive actions	Expt I	22.5	19.6	13.1
(sniffing & contact)	Expt II	101.7	34.4	6.7

[a]Average scores for both animals in isolate-isolate, isolate-grouped, and grouped-grouped encounters.

field in either experiment. Apparently either the presence of goal objects or the relative complexity of the cross maze facilitated exploration. Furthermore, all groups of animals in Expt I chose the arm containing the mouse more often than any other arm. The mouse was considerably more active than the goal guinea pig, climbing on the wire and sometimes nipping the test animal.

Animals in the social interaction test of Expt I showed no differences in tendency to make nonaggressive contacts. However, isolate-isolate encounters produced more aggression than any other pairings. Age at onset of isolation seems to be an important factor in determing aggressiveness. Isolates in Expt II engaged in only a few minor skirmishes, and only nonaggressive social behavior was significantly increased relative to grouped controls. Goldberg and Welch (1972) found that mice isolated for 1 mo immediately after weaning fought intensely when tested with other animals, while mice which had lived together for 2 mo and were then isolated for 1 mo hardly fought at all. Fara and Catlett (1971) found that guinea pigs which had lived together until age 6 mo and then were isolated for 1 wk before testing fought only 8 times out of 40 pairings. Apparently there is a period shortly after weaning when either learning of or tendency to use aggression-reducing communication may be hampered by isolation.

Several studies have found that grouped males of various species have lighter body weights, lighter testes, and heavier adrenal glands than isolated animals of the same species (see Christian, 1963). This relationship has been interpreted as a reaction to the stress of grouping, but has not been found to hold universally (Bell, Miller, Ordy, & Rolsten, 1971; Geller, Yuwiler, & Zolman, 1965; Hatch, Wiberg, Balaza, & Grice, 1962). Crowded gerbils exhibited the above reactions, as well as declines in social behaviors, in same-sex but not in mixed-sex groups (Hull *et al.*, in press). Species differences have also been found, with more docile animals showing fewer

physiological reactions to isolation or grouping (Bronson, 1963). Since the guinea pig is generally a docile animal, the lack of physiological reaction to rearing conditions is not surprising.

Variability of results in this and other experiments indicates that at least in guinea pigs "sociability" does not respond in a consistent fashion to manipulation of housing conditions. Furthermore, it seems inappropriate to speak of "sociability" or "gregariousness" as unitary concepts, for they almost certainly include elements of curiosity and aggressiveness, as we have shown, and probably also playfulness and sexual interest.

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