an effect similar to that obtained with RNA can be demonstrated with stress-affected whole brain or liver substance. Thus, if controls are not made for such factors as stress, it seems inappropriate to conclude that the RNA specific memory hypothesis is adequate, or even accurate.

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12. This research was carried out under NSF grant GB-7041. We wish to thank Drs. D. Stevens, M. Weiner, and N. Rankin for their thoughtful criticisms of this manuscript, and K. Gans, F. Watkins, J. Galla, M. McIntyre, and D. Cooper, without whose efforts this research would have been impossible.
13. Requests for reprints may be addressed to Donald G. Stein.

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Olfactory Stimuli and the "Pseudo-Extinction" Effect

Wasserman and Jensen (*1*) demonstrated that continuously rewarded rats showed a decrease in starting speed on a runway recently traversed by other rats undergoing experimental extinction. They showed a less clear-cut effect on mean running speed. Their conclusion was that their "results indicate that the odor trace of a rat undergoing experimental extinction can significantly disrupt the performance of a subsequently run animal that was continuously reinforced."

Another observation that they made was that all rats undergoing experimental extinction urinated while none of the other experimental rats did. Thus one might conclude that the observed effect was produced by (i) an odor emitted by extinction rats as hypothesized by Wasserman and Jensen, (ii) an odor emitted by the urine of such rats, or (iii) an odor emitted by the urine of any rat. In the absence of further information, I would prefer the last of these hypotheses, which requires the postulation of no psychological mechanism, but merely a simple physical interference by the odor of urine with the ability of the experimental rat to catch the scent of the reward pellet. A delay in picking up the scent would affect starting speed more than running speed; hence this mechanism would also explain the differences observed between figures 1 and 2 of Wasserman and Jensen. They do not explain these differences, but speculate that "the repeated testing procedures had differential [sic] effects on running than on starting times."

To test which hypothesis is correct, another control experiment could be conducted in which rats are continuously rewarded on a runway that has been treated with the urine of rats not undergoing experimental extinction. As Wasserman and Jensen state at the end of their paper, "Control for odor effects would seem desirable if interpretation of experimental outcomes is to be unambiguous."

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Some of the comments by Deutsch appear to be answered by a careful reading of our paper (*1*). We attributed the "pseudo-extinction" effect to discriminable odors emitted by rats undergoing experimental extinction. We felt, and still feel, that this conclusion is consistent with our data. Contrary to Deutsch's contention, we did not speculate as to the exact nature of the olfactory stimuli involved. We explicitly stated that our experiment did not identify precisely what these olfactory stimuli were, ". . . particularly whether these stimuli are isolable from those of the excretory products deposited by the ET (extinction trace) animals." The question of the exact origin and chemical composition of the odors involved is interesting and important in its own right, but it was peripheral to our problem (the explanation of pseudo-extinction), our hypotheses, and our conclusions.

Deutsch's other comments appear to rest on an unusual and possibly naive hypothesis regarding the cues that control the behavior of rats on the runway. He suggests that urine deposited by ET animals caused a "delay in picking up the scent" of reward pellets in the runway in animals subsequently placed on the runway (odor recipients). This hypothesis presumes that the performance of the rat on the runway was controlled by olfactory cues from reward pellets in the goal box rather than by habit and expectancy which have been conditioned to handling and apparatus cues. This hypothesis is, however, inconsistent with the behavior of ET rats. If the hypothesis were correct and if the animals running in the alley were "picking up a scent" of reward pellets, then on the first extinction trial ET animals would show decreased starting and running speeds since food and food odor were not present. No such effect was observed in ET animals when they were first placed on extinction (*2*).

While Deutsch's hypothesis may appear simpler than our hypothesis of differential sensitivities of starting and running speeds to experimental manipulations, his hypothesis is refuted by our data. Even though Deutsch's hypothesis has been found to be implausible, it was testable and scientifically meaningful. Such cannot be said for his distinction between "simple physical" and "psychological" mechanisms.

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