

Rodenticide Flavor Profiles Identified through Generalization of Conditioned Flavor Avoidance^a

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In these experiments, we investigated whether generalization of conditioned flavor avoidance (CFA) could be used to profile the components of flavors that we believed to be complex. Our studies also were designed to provide data of practical importance, in that five rodenticides (α -chlorohydrin [1.6 mg/ml], α -naphthylthiourea [ANTU: 150mg/ml], calciferol [100 mg/ml], strychnine [100 mg/ml], Na warfarin [27mg/ml]) were used as conditioned stimuli.

With one exception, experimental groups were presented with a rodenticide conditioned stimulus (CS) in aqueous solution on the day of treatment. For strychnine, experimental groups were presented with the CS either in aqueous solution or in agar. In all cases, ingestion of the CS was followed by an intraperitoneal injection of LiCl. Control groups were given water (or plain agar) followed by LiCl injections. Generalization of CFA to four nontoxic flavors was then assessed. Additional conditioning and generalization trials followed until 24 flavors had been presented. CFA was exhibited toward all rodenticides, and avoidance generalized in every case to a subset of the 24 flavors. Generalization of CFA to aqueous strychnine was exhibited toward "bitter" flavors (0.2 M, 0.04 M Na saccharin, 0.41 M Na₂SO₄, 0.1 M (NH₄)₂CO₃, 0.1 M MgSO₄, 0.1 M L-phenylalanine, 3.0 M urea, 0.001 M SOA, *ps* < 0.05). Generalization of CFA to strychnine in agar was similar, although relatively fewer test flavors were avoided by the experimental groups (i.e., 0.2 M and 0.04 M Na

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saccharin, 0.0001 *M* QHCl, and 0.001 *M* SOA; *ps* < 0.05). Warfarin CFA was relatively weak, but generalization was exhibited toward "bitter," "sweet," and "salty" (0.1 *M* MgSO₄, 3.0 *M* urea, 0.1 *M* sucrose, 0.1 *M* KNO₃, 0.15 *M* L-phenylalanine, 0.001 *M* SOA, 0.1 *M* NaCl, *ps* < 0.05). Calciferol CFA generalized to "sweet" and "bitter" (0.1 *M* sucrose, 0.2% quassia, *ps* < 0.05), ANTU CFA primarily to "sour" (0.3 *M* NH₄Cl, 0.01 *M* acetic acid, 0.003 *M* citric acid, 0.1 *M* HCl, *ps* < 0.05), and α -chlorohydrin CFA to "sour" and "bitter" (0.3 *M* H₄Cl, 0.01 *M* acetic acid, 0.2% quassia, 0.2% gentain, 0.15 *M* L-phenylalanine, *ps* < 0.05).

These results demonstrate that rats can recognize the components of a complex flavor. However, we cannot as yet identify the specific sensory systems mediating either learning or response generalization. We also cannot discount the possibility that avoidance-mediated neophobia influenced consumption as well as flavor avoidance learning *per se*. Taste, texture, pH, and/or odor may have been involved (hence our use of the term flavor). Regardless, our results support the notion that flavor avoidance learning could be useful in the empirical development of rodenticide baits and prebait formulations. Moreover, the similarity of strychnine flavor profiles in drinking and feeding contexts suggests that the results of these flavor profiling experiments may have broad validity. An important cautionary note, however, is that differences in strychnine flavor profiling in feeding and drinking were sufficiently great to suggest that aqueous solutions of the rodenticides and flavors used in the experiments may not wholly represent the flavors of rodenticides incorporated into solid baits. Further experiments are required in which solid stimuli or commercial bait formulations are used.