Strain differences among mice in taste psychophysics of sucrose octaacetate

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Abstract. SWR/J inbred mice consistently avoided a 10^{-4} M sucrose octaacetate (SOA) solution in unconditioned two-bottle preference tests whereas mice of all other inbred strains tested did not (confirming a previous report that used SWR mice of a different subline). In a conditioned taste aversion procedure SWR/J mice avoided SOA at concentrations from 10^{-3} M to 10^{-1} M but not at 10^{-4} M. Various other inbred strains first failed to avoid SOA at concentrations from 10^{-3} M to 10^{-5} M. The major strain difference between SWR and other inbred mice was robust across rearing regimes and when tested with other psychophysical procedures. In single-bottle, free-licking tests SWR/J mice differed from C57L/J mice in response to SOA following extremely brief exposure to the SOA. The SOA detection threshold differences indicated by these psychophysical procedures are also consistent with differences reported from electrophysiological recordings from glossopharyngeal and chorda tympani nerves in mice of several of the same strains.

Introduction

Sucrose octaacetate (SOA) is one of a very small set of tastants for which there are reports in the literature of possible major genetic differences among mice in taste sensitivity. Warren and Lewis (1970) reported that some individual wild mice (Mus musculus) and one inbred strain (CFW/NIH) avoided the bitter tastant SOA at concentrations (10^{-2}, 10^{-4} and 10^{-5} M) to which other inbred and wild mice were indifferent. Similarly, Lush (1981) reported that mice from one inbred strain (SWR/Lac) avoided 10^{-4} M SOA while individuals from 30 other inbred strains did not avoid SOA at that same concentration. Furthermore, both Warren and Lewis (1970) and Lush (1981) reported cross-breeding data which were compatible with an interpretation that differences at a single genetic locus might be responsible for the observed differences in behavioral response to SOA. Such a genetic system, in which variation at a single locus has a major effect on a sensory system, could provide the basis for application of powerful genetic approaches (Foster et al., 1981) to a fundamental analysis of the sense of taste.

However, although CFW mice were the inbred strain which avoided SOA (presumptive tasters) in Warren and Lewis' (1970) report, CFW mice did not avoid SOA in Lush's (1981) report. For Lush (1981), the CFW strain was similar to most other strains, while mice of another inbred strain (the SWR) were the only tasters of SOA. Such differences in results between laboratories could be due to genetic differences between the particular lines (substrains) used in each investigation. Environmental variables ranging from diets to details of behavioral testing might also contribute to differential results between laboratories.

The series of experiments presented below were performed to investigate both the replicability and robustness across testing regimes of differences among inbred mice.
in response to SOA, to estimate the magnitudes of such differences, and to investigate the extent to which the behavioral differences are based on differential chemosensory sensitivity.

Experiment I

Both Lush (1981) and Warren and Lewis (1970) presented animals with two drinking bottles, one containing a solution of SOA and the other containing a control vehicle. The primary data were then free-access preference ratios (amount consumed from SOA-containing bottle/amount consumed from both bottles), averaged across days of testing. Warren and Lewis tested individual animals while Lush (1981) presented “cage scores” from preference testing of group-housed animals on some occasions, and presented data from individual animals on other occasions. Our first experiment investigated free preference ratios for SOA among individual mice from a number of inbred strains. Unfortunately we were unable to locate descendants of the particular inbred line (CFW/NIH) reported to be SOA-tasters by Warren and Lewis (1970). Hence, our purpose was to see whether the marked strain differences reported by Lush (1981) could be replicated in our laboratory with mice from a different source.

Method

Subjects. A total of 110 adult male mice (Mus musculus) from 12 inbred strains (A/J, AKR/J, B6D2F1, C57BL/6J, C57L/J, DBA/2J, LP/J, NZB/BINJ, RF/J, RIHS/J, SJL/J and SWR/J) from Jackson Laboratory, Bar Harbor, Maine, served as subjects. Upon arrival in our laboratory the mice were individually housed in 10 x 24 x 13 cm wire-bottomed stainless steel cages, in temperature/humidity controlled rooms, on a 12 h light: 12 h dark cycle. Purina Rodent Lab Chow 5001 and water were available ad libitum. The mice were 60 - 120 days old when tested, and had been in our laboratory for at least 10 days prior to testing.

Apparatus. The mice were rehoused in modified stainless steel cages, similar to the home cages described above, for testing. The modification consisted of a metal plate welded to the front of the cage upon which three metal clips were mounted. These clips held inverted 25 ml graduated cylinders, with sipper tubes, in any of three positions, left, right, or center. Tastant solutions and control vehicles were presented to the mice in these cylinders.

Solutions. The 10⁻⁴ M SOA solution was prepared as described by Lush (1981) except that we used distilled water rather than tap water. The SOA (Sigma Chemical Co., St. Louis, MO) was first dissolved in ethanol because of its rather low solubility in water, and then diluted with distilled water to a final concentration of 10⁻⁴ M SOA and 0.4% ethanol. The comparison solution was 0.4% ethanol in distilled water without SOA.

Procedure. All testing was done in a room separate from those in which the mice were normally housed. For 72 mice from 9 strains (A/J, AKR/J, B6D2F1, DBA/2J, LP/J, NZB/BINJ, RIHS/J, SJL/J and SWR/J), testing consisted of six consecutive, 24 h, two-bottle preference tests. A cylinder containing the tastant solution (10⁻⁴ M SOA in 0.4% ethanol solution) and a cylinder containing the vehicle 0.4% ethanol solution) were placed on each cage in the right and left positions, respectively. The amount consumed from each cylinder was recorded after each 24 h period, cylinders were refilled as needed, and the positions of the tastant and vehicle cylinders were reversed for the next 24 h period.

The remaining 38 mice from six strains (C57BL/6J, C57L/J, LP/J, NZB/BINJ, RF/J and SWR/J) were also given two-bottle preference tests with 10⁻⁴ M SOA as above. However, these mice were tested for only 2 days with 10⁻⁴ M SOA (rather than six) and had been tested with 10⁻³ M SOA immediately prior to these tests (see below, Experiment II, unconditioned subjects for details of treatment for these animals).

For each mouse, a preference ratio was calculated for each 24 h period. The preference ratios consisted of the amount of SOA solution consumed divided by the total amount of liquid consumed from both tubes. On this measure equal consumption of both solutions yields a preference ratio of 0.50, and complete avoidance of the SOA solution yields a preference ratio of 0.00. The mean of the daily preference ratios was then calculated for each mouse.

Results

Mice from three inbred strains (LP/J, NZB/BINJ and SWR/J) were represented in both the first and second groups. No significant differences were found within these strains between those individuals tested in the first group and those tested in the second group (LP/J χ² = 0.43, χ² = 0.32, t (21 d.f.) = 1.21, p > 0.10; NZB/BINJ χ² = 0.44, χ² = 0.44; SWR/J χ² = 0.03, χ² = 0.03). Similarly, there was no significant difference for the nine strains of the first group between mean preference ratios calculated from just the first 2 days of testing and means using all six days, F(1,63) = 0.05, p > 0.25. It was decided, therefore, that the results from both groups could reasonably be combined.

Mean 10⁻⁴ M SOA preference ratios for all 12 strains are shown in Figure 1. It can be seen in Figure 1 that only the SWR/J strain avoided SOA (x ≈ 0.03). Very similar results were reported by Lush (1981), using free-preference ‘cage scores’ from group housed animals (SWR/Lac x = 0.036, Lush, 1981). The other strains were all indifferent to 10⁻⁴ M SOA (x’s = 0.32 - 0.62). In both experiments SWR mice (his from MRC Laboratory Animals Centre, Carshalton, England) appeared to be uniquely different from all other strains tested.

SWR mice were able to detect (avoid) 10⁻⁴ M SOA, a concentration which other strains did not detect. However, free-preference scores in general may be subject to considerable variation due to motivational factors. While very high or very low scores (high preference or strong avoidance) can presumably be interpreted as indicating the detection of a stimulus by an animal, scores near 0.50 can result either from an inability to detect the stimulus or from the lack of a tendency to prefer or avoid the stimulus once detected. A taste-aversion conditioning procedure was instituted in experiment II in order to motivate the mice to avoid SOA if able to detect it.
Experiment II

Taste-aversion conditioning, or 'flavor toxicosis conditioning', has been intensively studied in recent years (e.g., Barker et al., 1977; Spector et al., 1981). For application as an animal psychophysical technique in the chemical senses (Halpern and Tapper, 1971; Morrison and Jessup, 1977; Nowlis et al., 1980), the paradigm provides the advantage of generally enhanced reliability from a simple, single-trial conditioning procedure. Typically the animal is presented with a novel substance (conditioned stimulus, CS) to eat or drink. Shortly thereafter, the animal is exposed to a toxic substance (unconditioned stimulus, US). After just one such pairing of CS and US, animals typically avoid the CS, if detectable, during subsequent opportunities (Wysocki et al., 1977). The taste-aversion conditioning procedure adopted for this experiment paired a novel taste (SOA) with the toxic effects of lithium chloride (LiCl) injected shortly afterward. This procedure was expected to increase the likelihood that any mouse able to detect the SOA would avoid it upon subsequent exposures. The mice were also tested with a wide range of SOA concentrations in order to estimate detection thresholds for the various strains.

Method

Subjects. A total of 104 adult male mice from 11 inbred strains (A/J, BALB/cByJ, C57BL/6J, C57L/J, DBA/2J, I/LnJ, LP/J, NZB/BINJ, RF/J, SWR/J and 129/J from Jackson Laboratory) served as subjects. Ages and housing conditions were as described in experiment I.

Procedure. Upon rehousing in testing cages, the mice were placed on a 23 h/day fluid deprivation regime for five consecutive days. For 1 h each day cylinders containing 0.4% ethanol solution were placed on each cage, in the center position. The fluid deprivation was simply to ensure that the mice would drink from a cylinder containing $10^{-3}$ M SOA in 4.0% ethanol solution (the conditioning stimulus) which was placed in the center position of each cage for 10 min on the sixth day. At the end of this 10 min period, 66 mice from the 11 strains were weighed, then injected i.p. with 0.02 ml/g body wt. of 0.6 M LiCl, and returned to the testing cages. The remaining 38 mice (the same 38 mice from six strains that comprised the second group in experiment I) were also weighed, then returned to their cages, but were not injected. One hour after the last mouse was weighed the cylinders containing 0.4% ethanol solution were replaced on each cage.

Testing began on the seventh day. All mice received a series of 24 h, two-bottle, preference tests as in the first experiment. However, here the mice were given a descending series of SOA (and ethanol) concentrations from $10^{-3}$ M SOA (4.0% ethanol) to $10^{-8}$ M SOA (0.000004% ethanol) in log molar steps. For each test the SOA solution was in one bottle while the other bottle contained the corresponding concentration of ethanol in distilled water. Each concentration in the series was presented for a total of 48 h (two 24 h tests with SOA and vehicle cylinder positions reversed after 24 h). Primary data were each animal's mean preference ratio for the two days of testing at each concentration.

Results

Mean preference ratios across the series of SOA concentrations are presented in Figure 2, for each of the eleven strains tested after taste-aversion conditioning. A two-factor ANOVA (repeated on concentration) indicated significant main effects both for strain, $F(10, 55) = 8.53, p < 0.001$, and concentration, $F(5, 55) = 25.93, p < 0.001$. A significant interaction between these two factors was also...
found, F(50, 275) = 1.71, p > 0.01.

Using a preference ratio value of 0.25 (half way between indifference 0.50, and complete avoidance 0.00) as an arbitrary criterion for SOA detection, it can be seen in Figure 2 that the SWR/J strain avoided SOA at a concentration (10^{-7} M) at least 100-fold weaker than the concentrations avoided by any other strain. Particularly striking was the contrast between the SWR/J and C57L/J strains. The latter mice did not avoid SOA even at the highest concentration used (10^{-3} M).

Also shown in Figure 2 are means for those mice, in six strains, which were tested without taste-aversion conditioning. The results for conditioned and unconditioned mice in these strains were generally similar. However, for three of the six strains (SWR/J, LP/J and C57BL/6J) lower SOA detection thresholds were indicated by the conditioned groups than by the unconditioned groups (e.g., the LP/J mice clearly avoided 10^{-4} M SOA following conditioning, but did not when tested unconditioned). The taste-aversion conditioning procedure, presumably by motivating the mice to avoid SOA concentrations to which they might otherwise be indifferent, thus allowed the inference of lower detection thresholds for some strains.

Experiment III

Because of the low solubility of SOA in water, experiments I and II used an ethanol-water vehicle (as had previous studies, e.g., Lush, 1981). The possibility existed, therefore, that the results were due to some SOA-ethanol interaction rather than to SOA alone. The first two experiments above also used mice from a commercial supplier. Differences among strains in environmental variables experienced prior to their arrival in our laboratory (e.g., some strains are maintained on different optimal diets by commercial suppliers) could have had an effect on the SOA results obtained. Experiment III examined mice from selected extremely inbred strains in the absence of these possible confounding factors.

Method

Subjects. A total of 33 adult mice, both male and female, from three inbred strains (C57BL/6J, C57L/J and SWR/J) served as subjects (see Table 1 for numbers by strain and sex). The mice were bred in our laboratory from animals purchased from Jackson Laboratory. Each mating pair was housed in a 29 x 18 x 13 cm plastic cage with wood-chip bedding and a wire-mesh top. Food and water were available at all times. The pups were weaned at 23 days of age and were placed, with like-sex littersmates, in plastic cages identical to those described above. At 50 days of age the mice were individually housed in similar cages. Between 60 and 120 days of age the mice were rehoused in the modified stainless steel testing cages described in experiment I.

Solutions. It was suggested by an organic chemist that mild heating should allow appropriate SOA concentrations to be made without ethanol. A 10^{-3} M SOA solution, without ethanol, was prepared by heating the distilled water to just short of boiling in a glass beaker placed on a magnetic stirrer. Weaker concentrations were then obtained by serial dilution. Each solution was prepared 24 h before the test in which it was used, and was presented to the mice at room temperature (~23°C).

Procedure. The fluid deprivation and taste-aversion conditioning procedures described in experiment II were used for all 33 mice. However, the conditioning stimulus for the present experiment was 10^{-3} M SOA in distilled water (no ethanol). The control vehicle was distilled water alone. Also as in experiment II, the mice were given a descending series of SOA concentrations in 48 h, two-bottle preference tests began 1 h after conditioning. The SWR/J mice received SOA concentrations from 10^{-3} M to 10^{-8} M. The C57BL/6 and C57L/J strains were tested with concentrations from 10^{-3} M to 10^{-5} M only. The SOA and water cylinder positions were reversed after each 24 h period, and mean preference ratios were calculated for each mouse at each concentration.

Results

Figure 3 shows mean preference ratios for the three strains bred and raised under identical conditions in our laboratory, in relationship to means for bought-in animals tested with SOA plus ethanol (from experiment II). No significant difference was found between the two groups within any of the three strains (SWR/J, F(1,18) = 1.09; C57L/J, F(1,15) = 1.31; C57BL/6J, F(1,15) = 1.14; all p >0.25). This consistency of results indicated that the large differences in sensitivity to SOA among the various inbred strains were not likely due to ethanol effects or to possible variation in environmental factors, such as diet, to which the com-

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![Fig. 3. A comparison of conditioned preference ratios across SOA concentrations between mice of three strains bred in our laboratory and tested without ethanol (filled circles), and mice purchased directly from a commercial supplier and tested with SOA in ethanol solution (open circles).](image-url)
mercially supplied mice may have been subject. Nor was the sex of the mice found to be an important variable since the females had preference ratios comparable with those of the males ($p > 0.05$).

Experiment IV

The apparent concentration-response functions obtained in experiments II and III were produced using a descending concentration series only. Selection of this procedure was based on substantial prior work using taste-aversion conditioning with other tastants (Whitney et al., 1982). Nevertheless, extinction of conditioning, habituation, and order of testing could have affected the apparent SOA thresholds, particularly in the case of the SWR/J strain. In experiment IV the effect of such factors on the results for the SWR/J mice were examined.

Method

Subjects. Six male and six female adult SWR/J mice, bred in our laboratory, served as subjects. The ages, housing, and testing conditions for these mice were similar to those described in experiment III above.

Procedure. The fluid deprivation and conditioning procedures used in experiment III were also used here. The conditioning stimulus was again $10^{-3} \text{ M SOA}$ in distilled water. Unlike the previous experiment, however, these mice were tested only with $10^{-7} \text{ M}$ and $10^{-8} \text{ M SOA}$ rather than the entire series of concentrations. Two, 24 h, two-bottle preference tests were given at each concentration. As before, the first preference test began on the day after conditioning.

Results

Figure 4 illustrates the close similarity between this group tested only at $10^{-7} \text{ M}$ and $10^{-8} \text{ M}$ and the SWR/J mice from experiment III tested with the full concentration series. No significant difference was found between mean preference ratios for the two groups at these two concentrations, $F(1,21) = 0.28, p > 0.25$.

even though one group first encountered $10^{-7} \text{ M SOA}$ nine days after conditioning as part of a descending series of concentrations, while the second group first encountered $10^{-7} \text{ M SOA}$ on the first day after conditioning. These results are consistent with the suggestion that the concentration-response functions found for the SWR/J mice in experiments II and III are concentration-dependent, and not strongly affected by extinction, test order, etc.

The other strains were not exposed to this particular procedure. However, previous repeated tests with a single, suprathreshold concentration of other substances (e.g., PTC, cyclamate) indicated that taste-aversion conditioning induced avoidance in these strains was maintained through at least 4 days of testing (at least with substances which were not initially highly preferred). Since all but one of the 'non-taster' strains (LP/J) failed to avoid SOA within the first 4 days after conditioning (i.e., at $10^{-3} \text{ M}$ or $10^{-4} \text{ M}$; see Figure 2), the results for these strains also appear to be concentration-dependent.

Experiment V

All of the testing among inbred strains for SOA sensitivity reported above involved long-term measures (at least 24 h) and two-bottle choice paradigms. In such long-term choice tests a variety of variables other than, or in addition to, taste (such as post-ingestional factors, within-day position learning, etc.) could contribute to the observed preference behaviors. In the present experiment, mice from two extreme inbred strains were examined in detail for response to SOA during the first few seconds of their initial exposure to SOA in a single-bottle (no choice) paradigm. The occurrence of any differential responding to SOA upon initial exposure would be consistent with the suggestion that the earlier results were mediated at least in part by oro-pharyngeal sensory cues, possibly including ‘taste’ in the strict sense.

Method

Subjects. A total of 40 adult SWR/J and C57L/J mice (10 males and 10 females from each strain), bred in our laboratory, served as subjects. The ages and housing conditions for these mice were as described in experiment III.

Apparatus. One of the metal home cages was modified for use as a testing cage. A metal wall was inserted across the middle of the cage to restrict the mice to just the front half ($9.38 \times 11.25 \text{ cm}$). A single inverted 25 ml graduated cylinder was mounted behind a vertical slot ($3.13 \times 0.31 \text{ cm}$) in a thin metal plate on the front of the cage. The tip of the sipper tube was $3.44 \text{ cm}$ above the cage floor and was recessed $0.63 \text{ cm}$ from the metal plate during testing. The opening in the sipper tube was $0.27 \text{ cm}$ in diameter. Tongue contacts with the sipper tube (licks) were detected via contact lickometer circuits and were recorded by a computer which sampled for contacts every $10 \text{ ms}$. A sliding metal door across the front of the cage could be raised (lowered) to allow (prevent) access to the tube by the mice at the beginning (end) of each test session. The entire test cage was enclosed in a sound attenuating chamber equipped with a 7.5 W houselight.
Procedure. Each mouse was deprived of water in its home cage and given 8 days of preliminary training, prior to testing, to acclimate it to drinking in the test cage. On each day each subject was weighed and then placed in the test cage and allowed to drink from a cylinder containing distilled water. For the first 4 days, the sipper tube was flush with the metal plate, and the session length was 20 min. For the final 4 days, the tube was recessed behind the metal plate, and the session length was 10 min. At the end of each training session the mouse was again weighed, then replaced in its home cage. Between each mouse a fresh graduated cylinder with sipper tube was placed on the test cage and the cage was wiped with 70% ethanol. At the end of the 8 days of preliminary training, the mice were left in their home cages for another 4 days with food and water available ad libitum. This was to allow the mice to recover any body weight which had been lost during preliminary training.

Testing began on the following day. The water bottles were again removed from the home cages and the procedure for the last half of preliminary training was again used. Each mouse was tested with distilled water for 10 consecutive days to establish a baseline of responding. Then, on the eleventh day, they were given an SOA solution instead of distilled water in the single bottle. Solutions were prepared as described in experiment III above. Four mice from each strain (two males and two females) were tested with each SOA concentration (10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} M). Each mouse was given 0.5 ml of water in its home cage ~5 h after each of the eleven test sessions to help maintain body weight.

![Graph showing mean cumulative licks over time for SWR/J and C57L/J mice](image)

Fig. 5. Mean cumulative number of licks during the first 7.25 s of exposure to five concentrations of SOA (from 10^{-3} M to 10^{-7} M), in comparison with water, for SWR/J and C57L/J mice.

Results

The mean cumulative number of licks during the first 7.25 s of the single exposure to SOA are shown in Figure 5 along with the water baseline, constructed from the single preceding water day for all mice within a strain. As was found in the long-term two-bottle tests above, there was a clear difference in response to SOA between the C57L/J and SWR/J strains using this short-term, one-bottle, procedure. With all concentrations the C57L/J mouse maintained a pattern of steady licking throughout the period. A one-way ANOVA on cumulative licks at 7.25 s indicated no significant effect of concentration within the C57L/J strain F(5,34) = 1.17, p > 0.25.)

The SWR/J mice, in contrast, abruptly stopped licking within the first 3 s at each of the three highest SOA concentrations (10^{-3}, 10^{-4} and 10^{-5} M). A significant effect of concentration was found within the SWR/J strain at 7.25 s F(5,34) = 5.42, p < 0.005. Newman-Keuls multiple comparisons indicated that the SWR/J groups tested at 10^{-3} M and 10^{-4} M were significantly different from the 10^{-6} M SOA group and from the composite water baseline (data from all 20 SWR/J’s were used for this baseline). The groups tested at 10^{-3}, 10^{-4} and 10^{-7} M were not significantly different from water nor did 10^{-3} M differ from 10^{-4} M. The mean for 10^{-6} M was, however, larger than the means for 10^{-5} M and 10^{-7} M which, in turn were larger than the mean at 10^{-3} M (p < 0.01 for all significant differences above).

The findings above demonstrate the contrast in SOA sensitivity between the two strains with a psychophysical technique which is quite different from the previously employed long-term choice procedures. The results also indicate that detection of SOA by the SWR/J mice can be accomplished through immediate sensory input rather than requiring slower acting postingestional mediation. The SWR/J mice ceased licking 10^{-3} M SOA < 1 s (~5 licks) after first contact with the tube. Lower concentrations were apparently detected after increasingly more time had elapsed (10^{-4} after 1.75 s, 10^{-5} M after 2.5 s) and, presumably, greater amounts of SOA had been sampled. It is interesting to note that the orderly inverse relationship between concentration and time (or number of licks) at cessation of licking allows the responses by the SWR/J mice to the higher SOA concentrations to be differentiated. This was not possible due to a floor effect in the two-bottle preference tests.

General discussion

The five experiments (i) provide a replication of the previously reported difference in response to 10^{-4} M SOA between SWR mice and other inbred strains; (ii) present evidence (via taste-aversion conditioning) that this behavioral difference involves dissimilarity in ability to detect the stimulus, not just in preference for it; (iii) extend previous findings by establishing detection thresholds for the various strains, thus showing the magnitude of the SWR hypersensitivity (and also showing a relative hypoosensitivity in the C57L/J strain); (iv) demonstrate that the response difference is robust across several rearing and testing regimes; and (v) present evidence (via the short-term, single-bottle
tests) that SOA avoidance by SWR mice is based on immediate sensory input.

Previous studies dealing with SOA response differences among mice have not distinguished between stimulus detection and stimulus preference. Nor have various environmental sources of variation been ruled out as possible contributors to the differences found.

These unresolved points raised problems for both genetic analysis and psychophysical interpretation of the data. Determining the influence of environmental variables (especially those with obvious potential for affecting a taste phenotype, e.g., diet history, alcohol ingestion) is a necessary prerequisite to establishing a genetic origin for the observed behavior. Experiment III addresses this point and provides support for regarding the strain differences in SOA response shown here and elsewhere as due to genetic variation. The possibility that motivational factors (rather than, or in addition to, sensory factors) may have contributed to the behavioral differences seen is of greater concern to the psychophysical analysis of the data. The finding that the SWR mice remained much more sensitive than the other mice even with taste-aversion conditioning (Experiment II); and the finding that the SWR mice, unlike C57L/J mice, were able to discriminate between water and an SOA solution after a very brief exposure (Experiment V) suggest that the genetic variation producing the strain differences affects some aspect of chemosensory perception.

Further supporting this suggestion, and specifically implicating peripheral taste processes, are the similar strain differences found by Shingai and Beidler (in preparation) in glossopharyngeal and chorda tympani nerve electrophysiological responses to SOA applied to the tongue. SWR/J mice showed a marked response to \(10^{-3}, 10^{-4}\) and \(10^{-5}\) M SOA concentrations while several other inbred strains showed virtually no response to any concentration. With all other chemicals tested (including PTC and quinine) the SWR/J mice responded similarly to the rest of the strains. The SWR/J hypersensitivity appears to be specific to SOA and not a general response to bitter compounds. This agrees with behavioral data which will be reported in a later paper). However, neither Shingai and Beidler nor we have tested animals with strychnine. Lush (1982) reported a strong correlation between SOA preference and strychnine preference. The SOA tasting phenotype may therefore extend to a particular class of bitter compound, possibly mediated by a similar genetic mechanism.

The inferred strain-specific detection-thresholds for SOA are, not surprisingly, different for different psychophysical assessment procedures. The brief access single-bottle procedure with fluid deprived mice, as employed in experiment V above, was less sensitive than the two-bottle preference procedures. However, for SWR mice, it allowed differentiation of responses among concentrations which were not differentiated by the apparently more sensitive two-bottle long-term tests. The lowest detection thresholds resulted from two-bottle preference tests in the conditioned aversion paradigm. Further study of this apparent difference in taste sensitivity from a variety of perspectives could result in a genetic model system appropriate for fundamental analyses of the sense of taste.

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