A NOTE ON THE GUSTATORY SENSITIVITY OF AN ANTARCTIC WINTERING PARTY

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A pilot study was designed to test anecdotal reports which indicated that members of teams wintering in Antarctica undergo a decrease in gustatory sensitivity which continues to be noticeable for a brief period after their return to temperate zone living conditions. Although only four of an original group of 10 volunteers completed the experiment for various reasons, the results indicate no loss in sensitivity following one year of residence in Antarctica.

During the spring of 1972 an investigation into the gustatory sensitivity of members of a team who were to serve as the New Zealand wintering party at Scott Base was initiated in the Gustatory Psychophysics Laboratory of the University of Canterbury. The project had been stimulated by anecdotal reports from members of both the New Zealand and United States parties of previous years which indicated that members of groups returning from Antarctic bases experienced losses in both olfactory and gustatory sensitivity during their readaptation to temperate-zone living conditions.

On the basis of these reports we proceeded to test members of the 1972-1973 wintering party in a "before-and-after" study which was designed to detect small changes in gustatory sensitivity following one year of residence in Antarctica.

METHOD

The physical characteristics of the laboratory and the methodology of presenting stimuli and recording responses have been described in earlier publications (Gregson, 1964; Gregson and Simmonds, 1974). The subjects were available for individual sessions up to an hour in length. During this hour we gathered judgments on two experimental tasks. The first task consisted of a *detection series* of judgments in which five increasing concentrations of the four prototypical taste sensations (sweet, salty, sour and bitter) were presented (refer to Table 1).

On tasting each sample the subject was required to press one of two morse keys, indicating that the sample either tasted "exactly the same as water" (where water taste was defined before the commencement of each ascending series of the 5 concentrations of a given quality as the sensation elicited by a sample of deionised water) or that the solution tasted "different from water". It is pertinent to note

TABLE 1

Concentrations of the 20 stimuli used in the experiment expressed in grams of solute per litre of deionised water.

Glucose (Sweet)	7.5	10.0	12.5	15.0	17.5
Sodium Chloride (Salty)	0.25	0.50	0.75	1.00	1.25
Citric Acid (Sour)	0.02	0.03	0.04	0.05	0.06
Quinine Sulphase (Bitter)	0.003	0.004	0.005	0.006	0.007

that deionised water elicits a variety of qualitative sensations in gustatory threshold experiments (Gregson and Simmonds, 1974, McBurney and Shick, 1971).

The second experimental task, referred to as an *identification series,* consisted of a randomised sequence of the 5 concentrations of each of the 4 prototypical tastes (Table 1) in which the concentrations increased stepwise over each block of four trials, but the order of presentation of the 4 qualities was randomised within the block. In this task there were 9 response keys, labelled "no different from water taste", "faint sweet taste", "weak sweet taste", "faint salty taste", "weak salty taste", and likewise for the sour and bitter qualities.

Each subject judged each stimulus in the detection series and each stimulus in the identification series twice, yielding a total of 40 detection and 40 identification responses per subject. The subjects were required to rinse with distilled water at the end of each ascending series of 5 concentrations in the detection series, and after each stimulus in the identification series.

Of the original group of 10 volunteers the data from the identification series of one subject was lost from the pre-wintering measurements when an electronic failure developed in the automatic recording apparatus.

One year later, preparations were made to retest the returning subjects soon after their return flights from Antarctica to Christchurch. As they were scheduled to arrive at any time during the day or night we agreed in advance that any one-hour interval within 24 hours of their return to Christchurch would represent an adequate time lapse between leaving Antarctica and completing the post-wintering test. However, only four of the 9 subjects remaining in the original group met this requirement.

RESULTS

We present first the data pooled over the 10 subjects who completed the detection series of the pre-wintering session. Figure 1 depicts the frequency of emission of the response "tastes different from water" as a function of the increasing concentrations of the detection series stimuli. It is clear that the concentrations used span the subjects'

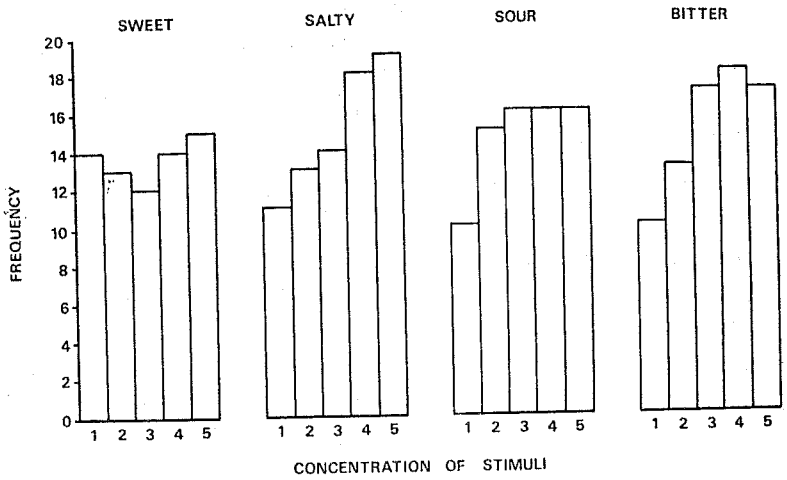

Figure 1. Pooled frequencies with which 10 subjects judged stimuli to taste different from deionised water in detection series.

regions of uncertainty, and that the frequency of responding in the category "different from water" in general increases monotonically with concentration. However, the profiles exhibit some surprising local deviations from monotonicity. This is due partly to the fact that we have used an equal interval series of concentrations within each qualitative type; other threshold studies in the literature have generally used a geometric series of stimulus concentrations. (It seemed that a closer estimate of the detection and identification thresholds could be obtained by using an equal interval series.) The irregularity of the pooled profiles suggest that the subjects found the task difficult, possibly because the gustatory noise characteristics of deionised water made it difficult for them to define consistently for themselves the meaning of the expression "tastes like water".

Figures 2 and 3 represent the pooled profiles from the identification series. Following Gregson's (1974) approach to the measurement of aguesias, the data were partitioned into three response types representing the relative probabilities that each stimulus was classified as generating a null response (indicating that the stimulus tasted the same as water), a false detection (in which the stimulus was identified as different from water, but was incorrectly named), or a correct identification.

The number of observations constituting these profiles was too small to warrant the employment of traditional statistical techniques to test

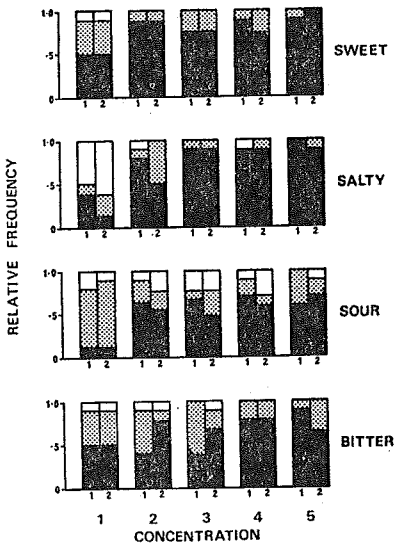

Figure 2. Pooled profiles showing sensitivity of 4 subjects before wintering (Bar 1) and after wintering (Bar 2) in Antarctica. Null response is shown by light areas. Incorrect identification by shaded areas, and Correct identification by dark areas.

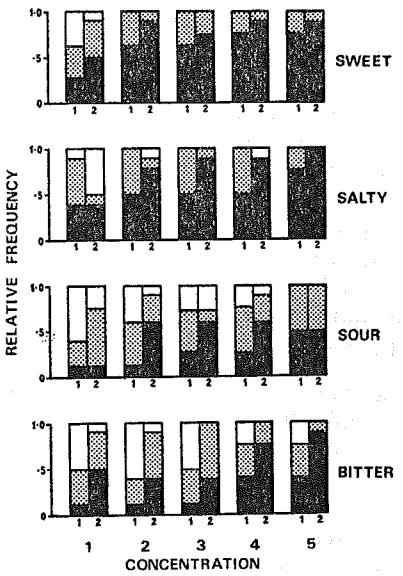

Figure 3. Pooled responses for the 4 subjects who failed to complete the experiment (Bar 1) and the 4 subjects who completed the experiment (Bar 2). Null response is shown by light areas, Incorrect identification by shaded areas, and Correct identification by dark areas.

for significant differences. The results are therefore presented as a pictorial summary of the trends present in the data. In Figure 2 the responses from the 4 subjects who met the requirement of returning for the post-test within 24 hours of arriving in New Zealand from Antarctica are pooled to contrast their performance on the task before and after wintering. Apart from some minor variations, the profiles correspond very closely. The available data indicate no change in measured sensitivity following wintering.

In Figure 3 the profiles for the 4 subjects who failed to return to the laboratory are compared with the profiles of the four who did return. In 17 out of 20 cases the profiles for those who returned show a higher frequency of correct identification than for those who did not return. The remaining three cases show no change. Although this does not represent statistically demonstrable difference, the apparent differences shown in the profiles are such as to make generalizations regarding the effects of wintering on gustatory sensitivity invalid if they were to prove to be proportionately sustained over a large sample of subjects.

CONCLUSIONS

There was no evidence to support the anecdotal reports of previous wintering parties which had indicated that subjects experience a loss of gustatory sensitivity following a period of wintering in Antarctica. The possibility remains that partial anosmias occur as a result of prolonged exposure to the cold, and this may have led the subjects to believe that their gustatory sensitivity had also declined (for example, the flavour of many substances is partially dependent upon olfactory cues). A second possibility is that respiratory infections contracted by members of earlier parties on their return to New Zealand may have induced temporary losses in chemical sensitivity. Our sample of 4 men appeared to be free of colds and influenza when they were tested. Their own reports indicated that they were unaware of any loss in sensitivity at the time they were retested in the laboratory.

The data suggest that those volunteers who returned for the post-wintering test were initially more sensitive to the stimuli used than those who failed to return. The attrition rate was therefore unevenly distributed across members of the original sample.

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