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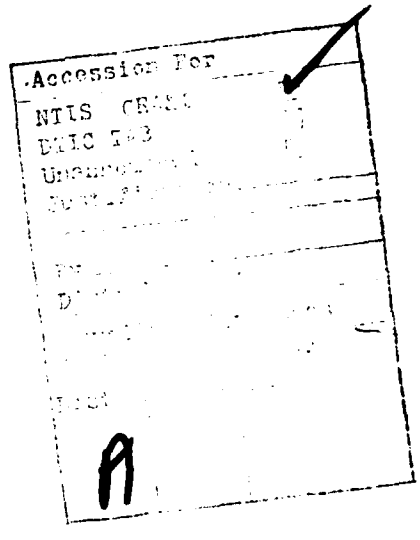

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Taste Neural coding Neural organization
Stimulus organization Olfaction

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Various aspects of the neural bases of taste were studied in rats. The main data were of the activity of single neurons in the peripheral nerve (chorda tympani) and medulla (nucleus of the solitary tract), although some studies were made of central taste projections with the 2-DG method, and data were obtained of the electrical responses in the cerebellum to stimulation of oral structures. The data were treated mathematically to determine various

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20. Abstract (continued)

aspects of their organization; previous to this, such treatments were largely lacking, leading to conclusions contested in the present research. The present findings were that the previous conclusions that taste is organized in terms of "four primary tastes" is an artifact of the methods used in characterizing the data; instead, the underlying organization is more continuous, as in the frequency dimension in audition, or wavelength in vision. This conclusion holds for both the stimulus and neural domains.

1. Statement of the problem

The primary problem in this research concerned the organization of neural activity underlying the perception of taste. Common knowledge in this field is that our taste world is composed of four primary tastes (sweet, sour, salty, and bitter), and that each of these is carried by a separate and private neural line, thus four neuron types, and that each of these in turn is activated by one of four separate receptor types (with some elaboration at the receptor level, with perhaps two "bitter" receptors, etc.). However, the data supporting these hypotheses are not clear. It was the purpose of this research to examine carefully, with neutral mathematical treatment of the data, the hypotheses of neural and stimulus types.

2. Summary of most important results

At both the peripheral (4, 6, 22) and medullary (3, 6, 8, 13) levels the neurons were found not to form classes, such as would be required for the suggested sweet-sour-salty-bitter types. The mathematical method of analysis was hierarchical cluster analysis based on the responses of many neurons (20 to 40) to many stimuli (up to 50). This analysis permitted inspection of the stimulus organization underlying the activity evoked in these neurons; no classes of stimuli were found, with the following provisos: classes of stimuli can be generated by the inclusion of a number of similar stimuli (such as several sodium salts or a number of similar acids, etc.), and there is a suggestion in the data that sweet stimuli may compose a group somewhat distinct from the other (salty, sour, bitter) stimuli which are not distinct from each other.

In addition, it was found that the temporal patterns of impulses in taste neurons may carry information about the nature of the stimulus (16, 20, 21) and that olfactory stimuli may modulate the activity of gustatory neurons (1, 2, 12).

3a. Publications

1. VanBuskirk, R. L., and Erickson, R. P. Odorant responses in taste neurons of the rat NTS. Brain Research, 1977, 135, 287-303.

2. VanBuskirk, R. L., and Erickson, R. P. Odorant-sensitive afferents of the gustatory region of the rat medulla. Neuroscience Letters, 1977, 5, 321-326.

3. Woolston, D. C., and Erickson, R. P. Concept of neuron types in gustation in the rat. Journal of Neurophysiology, 1979, 42, 1390-1409.

4. Erickson, R. P., Covey, E., and Doetsch, G. S. Neuron and stimulus typologies in the rat gustatory system. Brain Research, in press.

5. Erickson, R. P., and Covey, E. On the singularity of taste systems: What is a taste primary? Physiology and Behavior, in press.

6. Schiffman, S. S., and Erickson, R. P. The issue of primary tastes versus a taste continuum. Neuroscience and Biobehavioral Reviews, 1980, 4, 109-117.

7. Erickson, R. P. Common properties os sensory systems. In F. A. King (Ed.), Handbook of Behavioral Neurobiology. New York: Plenum Publishing Corp., 1978, 73-90.

8. Erickson, R. P. The role of "primaries" in taste research. Sixth International Symposium on Olfaction and Taste, 1978, 369-376.

9. Schiffman, S. S., Orlandi, M., and Erickson, R. P. Changes in taste and smell with age: Biological aspects. In J. M. Ordy and K. Brizzee (Eds.), Sensory systems and communication in the elderly (Aging, 10). New York: Raven Press, 1979.

3b. Papers presented

A. International Symposium on Olfaction and Taste, Paris, 1977:

10. Erickson, R. P., Hillson, R., Johnson, A., Lockhead, G., Orlandi, M., and Woolston, D. C. Neural and psychophysiological studies in gustation.
11. Erickson, R. P. The role of taste primaries.
12. VanBuskirk, R. L., and Erickson, R. P. Odorant responses in gustatory NTS neurons.

B. Neurosciences, St. Louis, 1978:

13. Woolston, D. C., and Erickson, R. P. No evidence for taste neuron types.
14. Doetsch, G. S., and Erickson, R. P. Coding of stimulus location and intensity in somesthesis: A neuronal population response model.

C. Gordon Conference, Andover, N. H., 1978:

15. Erickson, R. P. Neural and psychophysical bases of taste.

D. American Chemoreception Society, Sarasota, 1979:

16. McCumbee, E. D., and Erickson, R. P. Temporal coding in gustation.
17. Hillson, R. H., Schiffman, S., Erickson, R. P. The representation of neurons and stimuli in a multidimensional space.
18. Mintz, R., and Erickson, R. P. A search for taste-evoked activity in the cerebellum.
19. Welsh, K. A., McCumbee, E. D., and Erickson, R. P. "Basic tastes" perceived?

E. Neurosciences, Atlanta, 1979:

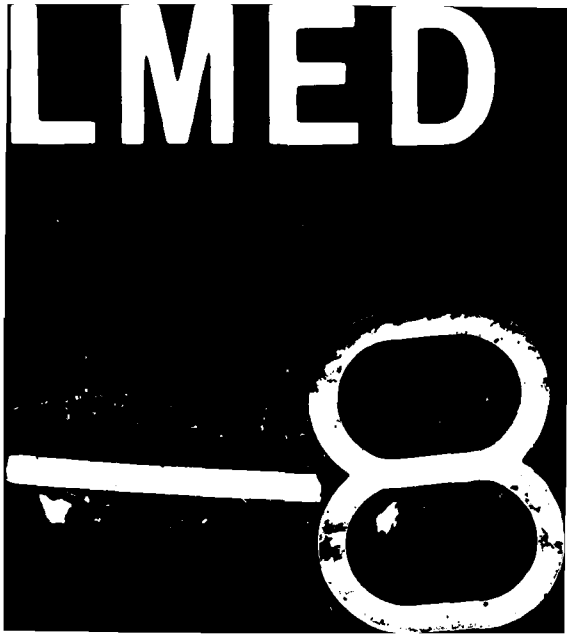
20. Covey, E., and Erickson, R. P. Temporal coding of sensory quality.

F. American Chemoreception Society, Sarasota, 1980:

21. Covey, E., and Erickson, R. P. Temporal neural coding in gustation. (In preparation for publication)
22. Erickson, R. P., Covey, E., and Doetsch, G. S. Neuron and stimulus typologies in the rat gustatory system.
23. Collins, L., Chiu, D., and Erickson, R. P. Tastes lose their identity in mixtures: A comment on the analysis/synthesis issue.

4. Participating personnel and advanced degrees awarded

Robert P. Erickson	principal investigator	
Mario A. Orlandi	graduate student research assistant	Ph.D. 9/80
Ellen Covey	graduate student research assistant	Ph.D. 6/8[illegible]
Donald C. Woolston	graduate student	Ph.D. 6/78
Roger Hillson	graduate student	Ph.D. 6/78
Harold Smoak	graduate student research assistant	
James Higgins	graduate student research assistant	
Robert Mintz	graduate student research assistant	
Martha W. Clarke	secretary	
Alan E. Johnson	laboratory technician	
Susan Ellis	laboratory technician	
Umberto Sartori	laboratory technician	
H. Schiffman	faculty	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