Lack of Basic Knowledge Bars Formation of Odor Theory

Conference on basic odor problems supplies more questions than answers

NEW YORK.—What is the yellowish brown pigment of the olfactory epithelium, and has it any connection with the perception of odor, asked James B. Sumner, director of the laboratory of enzyme chemistry at Cornell University, on April 23. Presenting the chemist's ideas on odor problems to a Conference on Basic Odor Research Correlation, sponsored jointly by the New York Academy of Sciences and the American Society of Heating and Ventilating Engineers, Dr. Sumner pointed out the possibility that this pigment might be "bleached by odorous substances in a manner analogous to the bleaching of rhodopsin by light."

Dr. Sumner, winner of a Nobel Prize in 1946, cited "the excellent piece of work" done by G. Wald, in which rhodopsin, the visual purple of the retina, was shown to be decomposed under the influence of light. This is the type of basic, exploratory research that is so badly needed in the field of olfaction, declared Dr. Sumner, since "far too little is known about the olfactory process to permit one to construct a complete theory."

The nasal epithelium is believed to contain as many as 10 million olfactory receptors, connected to the brain by about 100,000 nerves. However, said Dr. Sumner, "the mechanism by which chemicals stimulate olfactory receptors is entirely unknown."

Odorous compounds containing deuterium or optically active isomers, and enzyme poisons, and isolation of the enzymes of the nasal epithelium were some of the avenues of research recommended by Dr. Sumner. "The possible effect of color on odor sense should be tested out completely and thoroughly." The role of adenosine triphosphate in supplying the energy for the smelling process should be investigated.

The radiation theories of olfaction, said Dr. Sumner, are "unconvincing and even preposterous." These theories, postulating stimulation of the olfactory receptors by the production of infrared waves by odorous substances, are disproved by the fact that "the deuteroxyl counterpart of *n*-butyl alcohol has exactly the same odor as the original *n*-butyl alcohol, although its infrared spectrum is different." Also, "certain D and L compounds differ in smell, although here the infrared spectra are identical."

Since enzyme inhibition is seldom specific, and the concentration of odorous substances are often extremely small, the enzyme theories of olfaction are "most unlikely," declared Dr. Sumner. New and unusual enzymes and a mechanism of olfactory stimulation would have to be found to make this theory plausible.

The inactivation of such enzymes as alkaline phosphatase by odorous substances, and resulting stimulation of the olfactory nerves, is unlikely because some of the best inactivators are odorless substances. "An attempt to construct an artificial nose," said Dr. Sumner, "might lead to important discoveries."

Information Theory. People can learn to recognize at least 10,000 distinct odors, but can discriminate only about 30 levels of intensity, said Raymond M. Hainer of Arthur D. Little, Inc. Dr. Hainer, a physicist, compares the olfactory nervous system to a computer.

Each nostril has a lobe about as big as the end of the thumb, containing about 1900 glomeruli, called "telephone exchanges" by Dr. Hainer. Each glomerulus sends electrical pulses to the brain by way of 24 neurons, at the rate of 10 pulses per second. With only 24 neurons per glomeruli, it is possible to obtain 16 million different patterns, corresponding to 16 million distinct odors. The kind of odor depends on the pattern, but the strength of the odor depends on how many of the 1900 bundles of 24 neurons react to the odorant. The experience of odor intensity depends on the fraction of the equivalent fibers activated, the exact information of which is unsuitable both for the learning process and for complete storage. Odor quality, therefore, is represented discretely with precise memory, while odor intensity is more or less continuous and cannot be permanently remembered.

A mechanism for synchronizing the transmittance of the impulses along the neurons so that they will all reach the brain together is necessary. "Granular" cells, which hold up some impulses until the others are ready, are suggested by Dr. Hainer. The theory speculates that brain waves, at a frequency of 10 per second, release impulses simultaneously.

James B. Sumner (right) of Cornell discusses his paper on odor research with Amos Turk, research director for W. B. Connor Engineering Corp.

Odor Control. Successful control of odors arising from the processing of protein food products in a densely populated area can be accomplished by water mash, adsorption, chemical reaction and simple oxidation. Herman W. Dorn, Dorn and Co., reported that the chemical reaction was based on treating the odor-laden effluent vapors with a neutralizing jet-fed gas to produce a finely divided solid capable of ready dispersion in the atmosphere.

Odor Identity and Measurement. The need for quantitative identification and measurement of odor is basic to any projected study of the subject. Since most odorants are organic molecules, infrared and mass spectra are powerful analytical tools for this purpose, declared Amos Turk, director of research for Connor Engineering Corp. However, atmospheric odorants are such complex mixtures that their complete analysis by composite spectra is not yet possible, and preliminary fractionation and concentration steps must be carried out.