C_S

INTRODUCTION

Neurotransmitters and Neuromodulators in Gustation

Robert M. Bradley

Department of Biologic and Materials Sciences, School of Dentisitry, University of Michigan, Ann Arbor, MI 48109, USA

Correspondence to be sent to: Dr Robert M. Bradley, Department of Biologic and Materials Sciences, School of Dentistry, University of Michigan, Ann Arbor, MI 48109–1078, USA

Chem. Senses 21: 351–352, 1996.

A complex chain of neural events is initiated when a chemical is placed on the tongue that eventually leads to a taste sensation. Beginning with transduction and a receptor potential, the sensory information has to be transformed into action potentials that ascend from the periphery through the central nervous system. This process involves many synaptic junctions where the message is transformed and distributed to a number of different brain areas. While transduction has been a major focus of recent investigations in taste, synaptic processing, and the neurotransmitters and neuromodulators used by the taste system have received less attention. Obviously, an understanding of the role of neurotransmitters and neuromodulators in the gustatory system is very important if progress is to be made in comprehending how taste information is processed by the central nervous system. Thus, it is timely to examine the current knowledge of the role of neurotransmitters and neuromodulators in gustation. A symposium at the Association for Chemoreception Sciences Annual Meeting (AChemS XVII) recently focused on this topic to address the role of neurotransmitters and neuromodulators at the level of the taste bud and at the first central relay in the taste pathway—the nucleus of the solitary tract (NST).

The first report of this symposium is a comprehensive review by Steve Roper of the neurotransmitters and neuromodulators at the level of the taste receptors. Once transduction has taken place at the taste cell receptor membrane the information has to pass through a synapse between the taste cells and the primary afferent taste fibers. Suprisingly little is known about this essential event or about the identity of the neurotransmitter/s involved. As detailed in this report several investigators have attempted to study synaptic transmission at the taste bud. Histochemical, immunocytochemical and physiological techniques have been used in a number of different species with many conflicting results. Often an investigator produces a flurry of papers and then apparently abandons the effort. A few years later another investigator tries again, probably because new methods become available, to re-investigate the question of synaptic transmission at the level of the taste bud. Roper describes recent work from his laboratory indicating the significant role played by serotonin as a neuromodulator in the taste bud, but also reports that the identity of the neurotransmitter released at the taste cell–primary afferent fiber synapse is still unknown.

In the last three reports information is presented on neurotransmiters and neuromodulators at the level of the NST. Synaptic events at the first relay in the central taste pathway are also little understood, as are the neurotransmiters

involved in synaptic transmission. In recent years there has been a concerted effort to study the morphology of synapses in the NST and several investigators have applied immunocytochemical techniques to identify the potential neurotransmitters and neuromodulators that are present. The report by Bruce Maley details the surprising number and variety of neuroactive compounds present in the NST. The distribution is not uniform; different parts of the NST contain different amounts and types of neurotransmitters and neuromodulators. The reports by Robert Bradley and Michael Andresen provide information on what some of these neuroactive compounds may be doing. Both of these reports use the brain slice preparation to examine synaptic events and use pharmacological agents to identify the neurotransmitters active at the initial synapse. Bradley has confined his investigations to the gustatory NST, while Andresen has investigated the baroreceptor relay in the caudal NST. Both investigators report that glutamate is probably the major transmitter involved in synaptic activity at the primary afferent synapse to the NST. However, while there are similarities between rostral and caudal NST there are significant differences. For example, both NMDA and non-NMDA receptors seem to be active in the rostral NST, but at the caudal NST, non-NMDA receptors predominate.

Future work on neurotransmitters and neuromodulators in the gustatory system will provide valuable insight into how the transduced information is transmitted and altered as it ascends the CNS. Without this knowledge it will be difficult to understand how chemosensory information is encoded to produce the wide variety of behavioral events we associate with gustation.