

A Critical Review of 5-HT Brain Microdialysis and Behavior

Lynne E. Rueter, Casimir A. Fornal and Barry L. Jacobs

Program in Neuroscience, Department of Psychology, Princeton University, Princeton, NJ 08544-1010, USA

SYNOPSIS

Serotonin (5-HT) has been implicated in many central nervous system-mediated functions including sleep, arousal, feeding, motor activity and the stress response. In order to help establish the precise role of 5-HT in physiology and behavior, *in vivo* microdialysis studies have sought to identify the conditions under which the release of 5-HT is altered. Extracellular 5-HT levels have been monitored in more than fifteen regions of the brain during a variety of spontaneous behaviors, and in response to several physiological, environmental, and behavioral manipulations. The vast majority of these studies found increases (30-100%) in 5-HT release in almost all brain regions studied. Since electrophysiological studies have shown that behavioral arousal is the primary determinant of brain serotonergic neuronal activity, we suggest that the increase in 5-HT release seen during a wide variety of experimental conditions is largely due to one factor, namely an increase in behavioral arousal/motor activity associated with the manipulation.

KEY WORDS

serotonin, motor activity, stress, feeding, behavioral state, behavioral arousal

INTRODUCTION

Serotonin (5-HT) has been hypothesized to play an important modulatory role in many central nervous system (CNS)-mediated processes. Drugs acting on the brain serotonergic system have therapeutic value in the treatment of many conditions such as depression, obsessive-compulsive disorder, anxiety and obesity. It has been left to the basic neuroscience researchers to fully define the functioning of the serotonergic system and to identify the naturalistic conditions under which this system is activated or inactivated.

Early studies on the brain serotonergic system employed methods that induced gross changes in central 5-HT levels, e.g. brain lesions or global neurochemical depletion. These studies indicated that 5-HT was involved in motor activity, feeding, sleep, and stress /16,3,40,7/. However, while 5-HT was found to influence these behaviors, it did not appear to be necessary for them to occur. Because 5-HT neurons widely innervate the CNS and have been hypothesized to play a role in many physiological and behavioral processes, the question of whether 5-HT has a specific role in any of these processes remains unclear.

With the advent of more sensitive and/or more specific techniques, researchers have been able to study the functioning of the serotonergic system in relation to specific behaviors in freely moving animals. For example, using electrophysiological recording techniques, the single-unit activity of serotonergic neurons within various raphe nuclei can be monitored in behaving animals. Furthermore, the endogenous release of 5-HT in the CNS can be measured during behaviors, using microdialysis or voltammetry. Thus, determining when and where 5-HT is released may help to delineate a precise physiological role for 5-HT in the CNS.

The aim of this review is to examine the role of 5-HT in the CNS, from a neurochemical perspective, by focusing on studies which have measured

Reprint address:

L.E. Rueter
Neurobiological Psychiatry Unit
McGill University
1033 Ave des Pins, O.
Montreal, PQ H3A 1A1, Canada

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