Archives Italiennes de Biologie, 137: 151-160, 1999.

HIPPOCAMPAL TYPE 1 (MOVEMENT-RELATED) THETA RHYTHM POSITIVELY CORRELATES WITH SEROTONERGIC ACTIVITY

C. GEMMA, L. IMERI AND M. MANCIA

Istituto di Fisiologia Umana II, Università degli Studi, Via Mangiagalli 32, I-20133 Milano, Italy

INTRODUCTION

The classical observations by Green and Arduini (12) showed that the neocortical and hippocampal EEG are different and that an "inverse relationship ... frequently exists between the activities of the two", the hippocampal activity being "almost the reverse of that of the cerebral cortex". Green and Arduini's paper is considered "the benchmark for the beginning of the intensive study" (2) of the synchronous, high amplitude hippocampal EEG activity, which is recorded during neocortical desynchronization and is well known as hippocampal ϑ rhythm. It has been later proposed to differentiate this synchronous activity into a type 1 Rhythmical Slow Activity (RSA), observed during wakefulness (W) and, particularly, exploratory behavior and voluntary movements (such as walking, swimming, digging) and a type 2 RSA, present during desynchronized sleep (DS) and immobility (reviewed in ref. 2, 3, 22).

On the basis of pharmacological evidence, it has been proposed that in rats hippocampal type 1 (movement-related) RSA is generated by serotonergic mechanisms, whereas hippocampal type 2 (immobility-related) RSA is cholinergically mediated [reviewed in (3)]. The aim of the present work was to evaluate if there is a correlation between spontaneous hippocampal type 1 RSA and hippocampal serotonergic activity in freely behaving rats. To this purpose simultaneous recordings of: *i)* hippocampal EEG, *ii)* sleep-wake activity (polygraphically defined), and *iii)* hippocampal levels of the serotonin (5-HT) metabolite 5-hydroxyndolacetic acid (5-HIAA - measured by *in vivo* voltammetry and infrared telemetry) were performed. As previously shown the use of a telemetry system for voltammetric signals allows simultaneous neurophysiological and neurochemical recordings in the same animals (6, 14, 15). The relatively high sampling rate (2 minutes) allowed by *in vivo* voltammetry provided the basis for a detailed analysis of the relationship existing among the variables under investigation.

Correspondence to: Prof. Mauro Mancia, Istituto di Fisiologia Umana II, Università degli Studi, Via Mangiagalli, 32, I-20133 Milano, Italy; fax +39-02-70638565; e-mail: mauro.mancia@unimi.it