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Enhanced Release of Norepinephrine in Rat Hippocampus during Spontaneous Alternation Tests

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Recent evidence suggests that release of acetylcholine (ACh) in the hippocampus is associated with performance on a spontaneous alternation task and with enhancement of that performance by systemic and central injections of glucose. The present study extended these findings by examining norepinephrine (NE) release in the hippocampus using in vivo microdialysis while rats were tested for spontaneous alternation performance with and without prior injections (ip) of glucose. Microdialysis samples were collected every 12 min and assayed for NE content by HPLC-ECD. Like ACh, NE release in hippocampus increased during spontaneous alternation testing. As in past experiments, administration of glucose (250 mg/kg) significantly enhanced alternation scores. However, glucose did not influence NE release either during behavioral testing or at rest. These findings contrast with prior evidence showing that glucose augments testing-related increases in ACh release. The findings suggest that norepinephrine is released within the hippocampus while rats are engaged in alternation performance. However, increased release of norepinephrine apparently does not contribute to the enhancement of alternation scores produced by glucose.

Key Words: hippocampus; norepinephrine; behavior; glucose; microdialysis.

INTRODUCTION

The ability of glucose to enhance learning and memory, as well as to influence other brain functions, is well documented in rodents and humans (Benton, Parker, & Donohoe, 1996; Gold, 1991, 1995a, 1995b; Messier & Gagnon, 1996; Wenk, 1989; White, 1991). In rodents, the findings of many experiments demonstrate that administration of glucose near the time of learning enhances acquisition and later memory of information provided in a wide range of tasks. While initial experiments investigated the effects on behavior of systemic glucose administration, more recent evidence indicates that microinjections of glucose into specific brain regions have similar effects on learning and memory, suggesting that glucose effects on brain function may be mediated by direct CNS actions. For example, glucose infusions into the amygdala (Ragozzino & Gold, 1994), medial septum (Ragozzino, Parker, & Gold, 1992; Ragozzino, Unick, & Gold, 1996), and hippocampus (Ragozzino, Pal, Unick, Stefani, & Gold, 1998) enhance memory for tasks often, though not always

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