BRAIN AND COGNITION **30,** 1–3 (1996)
ARTICLE NO. 0001

INTRODUCTION

Special Issue on Inhibitory Mechanisms in Brain and Cognition

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Over the years physiologists, neuroscientists, and psychologists have considered the possible role of inhibitory processes in brain and cognitive functioning. Such notable historical figures as Sherrington, Freud, and Pavlov did early empirical and theoretical work related to inhibition. Later work was performed by Hull, Luria, Roberts, von Bekesy, and other well-known neuroscientists and psychologists. Today, the many researchers studying the role of inhibitory mechanisms include Bjorklund and Harnishfeger, Dempster, Diamond, Geyer, Hasher and Zacks, Howe and Brainerd, Roediger and Neely, and Steele, to mention just a few, as well as the authors of the papers in this special issue.

Contemporary researchers study the contribution of inhibitory mechanisms to such diverse phenomena as EEGs, selective attention, memory, psychopathology, childhood development and aging, cerebral specialization, hypoxia, and head injury. The papers in this special issue sample some of the various areas of brain and cognitive functioning in which inhibition has been implicated. In addition to examining different phenomena, the papers vary in their general approach; they include descriptions of new empirical studies, reviews of existing work, formal modeling, and conceptual analyses of both empirical and theoretical work on inhibitory mechanisms. All of the papers include important lessons for those investigating phenomena in which inhibitory processes are implicated.

Macmillan traces the very early history of the concept of inhibition in physiology and psychology. He provides examples of how inhibition was defined, examined, and used in 19th century thinking about brain and

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0278-2626/96 $18.00

thought, including work on such exceptional states as hypnosis and insanity, as well as normal thinking. Macmillan concludes with some important lessons from those early investigations for contemporary research on the role of inhibition, one lesson being possible confusion among distinct uses of the term inhibition.

Houghton and Tipper propose that inhibitory processes play an important role in selective attention and motor control. After a review of relevant neurophysiological and behavioral evidence and some demonstrations of elegant models that incorporate inhibitory mechanisms, they conclude that integration of research from the brain and behavior levels, as well as more comprehensive formal modeling, will be required to produce a complete understanding of selective attention, action, and related phenomena.

Winocur, Moscovitch, and Bruni examine the hypothesis that inhibition might contribute to episodic memory dysfunctions associated with temporal lobe lesions and normal aging. They specifically examine the basis for increased susceptibility to interference in the AB–AC paired-associate paradigm. The authors conclude that their findings are better explained by an increased reliance on implicit memory processes, rather than inhibitory failures, although the possibility remains that inhibition might contribute to the distinction between implicit and explicit memory.

Campbell and Arbuthnott examine how inhibitory mechanisms influence retrieval from semantic memory, specifically the retrieval of answers to basic multiplication problems. This mental arithmetic paradigm is highly susceptible to interference from prior problems. The authors demonstrate that the effect of earlier problems on error priming is nonlinear across intervening problems and they conclude that the findings are consistent with a rapidly decaying inhibitory process.

Chiarello and Maxfield analyze the possible ways in which inhibitory mechanisms could influence how the two hemispheres contribute to the performance of cognitive tasks. They distinguish between three varieties of interhemispheric inhibition—suppression, isolation, and interference—and conclude that the evidence for each is not yet convincing. Chiarello and Maxfield's analysis leads to suggestions for future work on the important topic of hemispheric cooperation and competition.

Dustman, Emmerson, and Shearer examine possible changes in inhibitory functioning across the lifespan. They review evidence for weakened inhibition in young children and the elderly, focusing on EEGs, ERPs, and other electrophysiological data. Additional research described by the authors indicates that the decline in inhibition with age may be delayed by vigorous physical activity, a conclusion that would have important implications for understanding and perhaps reversing declines in cognitive functioning with age.

In the final paper of the special issue, I describe a speculative model in which inhibitory processes contribute to the effects of numerous predictor

variables on an equally varied set of criterion behaviors. Consideration of the widespread role of inhibitory mechanisms may further the development of unified models for diverse phenomena in neuroscience and psychology, although much close analytical work remains to be done along the lines exemplified by other papers in this special issue.

The papers in this special issue barely scratch the surface of the vast amount of research and theory that is being amassed on the topic of inhibition. Moreover, as several papers clearly demonstrate, examining the contribution of inhibition to brain and cognitive processes raises difficult and subtle issues that will not be resolved easily. Perhaps bringing together researchers from different areas, as in this special issue, will help to answer some of the challenging questions that surround research on the diverse possible roles of inhibition in neuroscience and psychology.