

Preface

This book is a summary of talks given at a meeting held in Madison Wisconsin from 12–14 September 2004. This meeting was initiated by two of the editors (V.A.C. and S.M.S.) largely in recognition of the research career of the third editor, R.W. Guillery. Ray Guillery has enjoyed a long and productive career that is briefly summarized below. We thank the Provost’s Office of the University of Wisconsin (P.D. Spear, Provost), the University of Wisconsin Center for Neuroscience (T.P. Sutula, Director), the Swartz Foundation, and the Zeiss Corporation for their generous support for this meeting.

The theme of the meeting

It was the purpose of the meeting to address specific issues concerning the communication between thalamus and cortex. Three areas were emphasized, all of which focus on the dynamic interdependence of thalamus and cortex in the construction of percepts and actions: (1) the role of thalamocortical communication in cognition and attention, (2) the role of the thalamus in communication between cortical areas, and (3) the role of thalamocortical interactions in relating motor control to perceptual processing. Each of the speakers was asked to produce a chapter in advance to focus on one of these issues. The chapters were available online before the meeting and this ensured a productive discussion at the end of each of the six planned sessions.

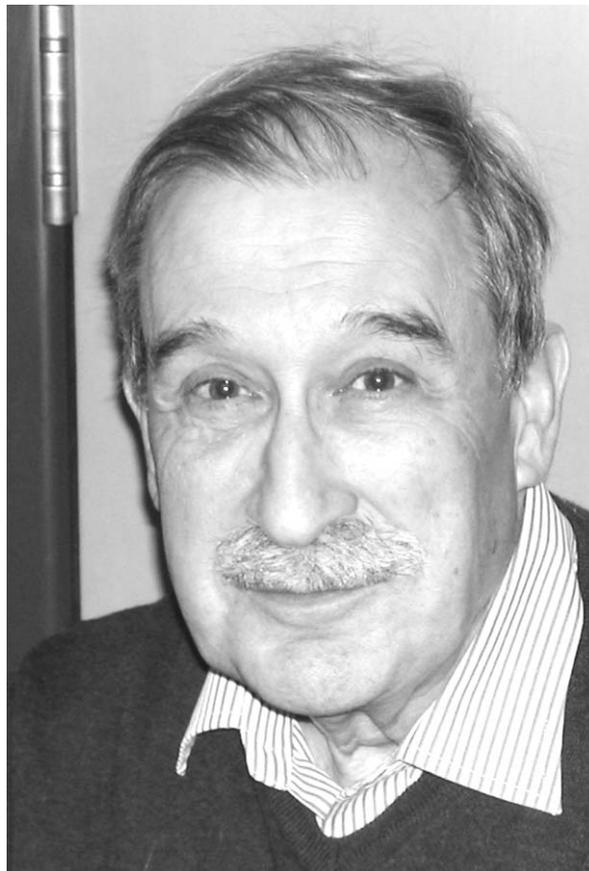
Almost all of the messages that are received by the cerebral cortex from the environment or from the body’s internal receptors come through the thalamus. Much current thought about perceptual processing is based on sensory pathways that relay in the thalamus. These sensory pathways are represented as transferring information to the cerebral cortex with subsequent processing in the cortex for eventual passage to cortical areas that have motor outputs or pathways to memory. One part of the meeting was concerned with defining how the passage of sensory messages to cortex depends upon attentional state, considering particularly the neuronal properties of thalamic and cortical cells that play a role in the first entry of sensory messages to the cerebral cortex. A second part explored the extent to which higher cortical areas, which receive their inputs from other (lower) cortical areas, do so by direct corticocortical pathways or through a “higher order” thalamic relay that receives inputs from one cortical area and sends signals to other cortical areas. A third part of the meeting examined the relationship between the classical sensory pathways and the motor outputs of the brain. Many of the sensory pathways that are relayed to cortex by the thalamus, and many of the trans-thalamic corticocortical pathways mentioned above are made up of nerve fibers that also send branches to subcortical motor or premotor centers of the brain. That is, the messages that are passed through the thalamus to cortex represent copies of motor instructions (corollary discharges). Evidence for such patterns of corollary discharge were considered, and the significance of these early motor connections for understanding the role of cortical functions in motor control and in perceptual processing

were discussed. Each of these areas, the dynamic role played by thalamic relays, the role of thalamus in corticocortical communications, and the thalamocortical pathways as copies of motor instructions represent some radical new concepts of thalamocortical functioning. The implications of the connectivity patterns that are important for understanding attentional mechanisms and also for new insights into perceptual mechanisms and their relationships to motor control.

V.A. Casagrande, R.W. Guillery, S.M. Sherman

The career of Ray Guillery (by Tom Sutula)

Ray Guillery was born in Greifswald, Germany, in 1929. His father was a pathologist in the Charité Hospital in Berlin, where his mother also worked as a technician. Ray's grandfather was an ophthalmologist who had published on the subject of visual acuity in 1931. His maternal great-uncle, Otto Deiters, was an early and eminent neuroanatomist who published some of the first accurate descriptions of nerve cells, including axons and dendrites, which were briefly called "Deiters' processes". During the 1930s and through the Second World War, Ray attended six different schools in Berlin, Switzerland, Holland, and England. He was in the last class of the Rudolph Steiner School in Berlin that was closed because of resistance to the Nazi movement. After attending schools in Holland, Switzerland, and



finally, a Quaker school in Oxfordshire, he emerged as an adolescent who, in his own words, “was able to think of (myself) proudly, as English”.

Ray entered University College London (UCL) in 1948 on a scholarship to study medicine. By the end of the first year of medical school and later influenced by many discussions with J.Z. Young, he recognized that he preferred a career as a research scientist. He made a transition into Ph.D. training to pursue his interest in how morphology and connectivity could be informative about how the brain might work. As a graduate student he began a study on pathways of the hypothalamus, which evolved into a series of studies on connections of the fornix with the anterior thalamic nuclei.

Ray’s interest in thalamocortical relationships developed during a sabbatical visit in Madison in 1960–61, where he collaborated with Jerzy Rose and Clinton Woolsey, who had proposed that a single thalamic nucleus might project to multiple cortical areas. After moving to the Department of Anatomy in Madison in 1964, he performed a series of pioneering experiments about the organization of inputs to the lateral geniculate nucleus and the effects of visual deprivation. In this work and in subsequent observations about the organization of chiasmatic projections in Siamese cats and animals with albinism, he produced a detailed characterization of the structural organization of the mammalian lateral geniculate nucleus and visual system and on the effects of monocular deprivation on the organization of geniculate inputs.

In 1977, Ray moved to Chicago, where he assumed the chairmanship of the Committee on Neurobiology at the University of Chicago. In 1984 he returned to Britain as Professor of Anatomy at Oxford, serving as the founding editor of the *European Journal of Neuroscience*, and continuing his studies on synaptic structure and the organization of the thalamus and visual system. After reaching mandatory retirement age at Oxford in 1996, he returned to Madison where he continues to pursue his interests in the organization of the thalamus, and contributes to teaching and mentoring graduate students. His career-long administrative wisdom and experience have had an ongoing influence on the development of neuroscience at the University of Wisconsin.

Ray Guillery’s career, spanning continents and generations, has contributed to detailed understanding of the visual system, thalamus, and fine structure of the nervous system in more than 130 publications and books. He has been honored by election as a Fellow of the Royal Society and a Fellow of University College London.

Below are some of the publications that Ray himself deems the most interesting.

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