- Friday, January 8, 1999
  Neural Control of Vergence and Accommodation

  Over a number of years, my laboratory has been investigating the characteristics and roles of the central pathways involved in controlling vergence and ocular accommodation in primates. More recently, we have begun to investigate the neural mechanisms that transform sensory signals such as disparity and blur into the appropriate motor signals for these eye movements. To address these issues, we use a combination of behavioral, electrophysiological, anatomical, and inactivation techniques. Based on these experimental findings, this seminar will discuss the roles that midbrain, brainstem, cerebellar, and cortical neuronal populations play in controlling vergence and ocular accommodation in primates. Initially, I will briefly review the characteristics of the eye movements in question, the optical systems that we use to elicit them, and the optical and electronic systems that we use to measure them. Next, by way of an introduction to the neural control of vergence and accommodation, I will consider the behavior and roles of medial and lateral rectus motoneurons and of abducens internuclear neurons during vergence eye movements. I will also describe the behavior of Edinger-Westphal neurons during accommodation, and will discuss the behavior of midbrain near-response neurons, some of which provide input to medial rectus motoneurons. Based on the behavior of these midbrain near-response neurons, a model will be presented of the neural substrate for the cross-coupling between vergence and accommodation. I will then present more recent anatomical, physiological, and inactivation data concerning the roles of specific cerebro-ponto-cerebellar circuits involved in vergence and accommodation. In particular, I will discuss recent studies of frontal cortex that have revealed neurons displaying both sensory and motor activity related to these eye movements. In conclusion, I will identify some of the major questions that remain to be answered regarding the neural control of vergence and ocular accommodation in primates, and the ways in which we plan to address these questions.

  Paul Gamlin
  Visual Science Research Centre, University of Alabama