Structure, function, and gene expression in human and non-human primate cerebral neocortex

Abstract: The human neocortex is an extraordinarily complex structure which underpins some of our most defining behaviors, including elaborate social communities, material culture, and language, while also playing a central role in some of our most devastating diseases. Recent technological and analytical advances are enabling a more accurate and comprehensive understanding of cortical organization. These include the digitization of traditional histology, advanced surface-based neuroimaging, and the rapidly developing subfield of cortical gene expression, including single-cell and spatial transcriptomics. This lecture will first review the fundamental features of primate neocortex, such as size, folding, and lamination. Surfaced-based HCP-style neuroimaging and parcellation will be outlined and its advantages highlighted. Recent efforts at establishing human – NHP, and particularly human – macaque, homologies through inter-species cortical registration will be described. Lastly, emerging findings from studies of human and non-human primate cortical transcription and current efforts by consortia will be presented. The synthesis of neuroimaging, histology, and transcriptomics constitutes a daunting methical and organizational challenge but promises to deliver a far more complete framework for understanding cortical structure and function.