

Transcription factors and cortical patterning

Shen-Ju Chou

Institute of Cellular and Organismic Biology, Academia Sinica, Taipei, Taiwan

The mammalian cerebral cortex is a remarkably complex organ responsible for the perception of sensory stimuli, the execution of motor actions, learning, cognition, and consciousness. To perform such complicated functions, it is compartmentalized into multiple functional units or cortical regions, including the newly evolved neocortex and evolutionarily older paleocortex and archicortex. Each cortical region has unique cytoarchitectures, patterns of gene expression, and distinct sets of input and output projections to perform specific functions: the neocortex, consists of six layers of neurons and processes visual, auditory, and somatosensory inputs and implements motor functions, the piriform cortex, the major component in the paleocortex, consists of three layers of neurons and processes olfaction, and the hippocampus, the major component in the archicortex, consists of three layers of neurons and is involved in spatial learning and memory formation. The research in my laboratory concerns the patterning of the cerebral cortex into different cortical regions. We focus on the functions of transcription factors (TFs) in specifying neuronal properties in different cortical regions. Our goal is to understand the mechanisms (i) controlling the number of neurons produced in different cortical regions, (ii) endowing cortical neurons with their region-specific properties, and (iii) integrating cortical neurons into functional neuronal circuits. Uncovering the mechanisms controlling cortical regional specification would allow us to understand how the brain functions, which is the first step toward understanding cortical dysfunction in disease states.