TOHOKU FORUM for CREATIVITY

NEURAL STEM AND PROGENITOR CELLS AND NEOCORTEX EXPANSION IN DEVELOPMENT AND EVOLUTION

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Our group studies the molecular and cellular mechanisms of neurogenesis in the developing neocortex in the context of mammalian brain evolution, specifically the various types of cortical stem and progenitor cells (CSPCs), their modes of division, their lineages, and the neuron production resulting therefrom. With regard to (i) the site of mitosis and (ii) the absence or presence of ventricular contact at mitosis, three principal classes of CSPCs can be distinguished. First, CSPCs that reside in the ventricular zone (VZ) and that contact the ventricle where they undergo mitosis, i.e. the neuroepithelial cells, apical radial glial cells and apical intermediate progenitor cells, collectively referred to as apical progenitors (APs). Second, CSPCs that reside in the subventricular zone (SVZ) where they typically undergo mitosis and that have delaminated from the ventricle, i.e. the basal (or outer) radial glial cells and basal intermediate progenitor cells, collectively referred to as basal progenitors (BPs). Third, CSPCs that undergo mitosis in the basal VZ or in the SVZ and that retain ventricular contact at mitosis, called subapical progenitors.

Our group has been studying the following issues related to these CSPCs in the developing mouse, ferret, marmoset, macaque and human neocortex: (1) the various lineages from APs to BPs; (2) the machinery underlying BP delamination; (3) symmetric versus asymmetric cell divisions; (4) the microcephaly gene Aspm; (5) the AP marker prominin-1/CD133; (6) membrane particles released into the ventricle; (7) extracellular matrix, integrins, and progenitor self-renewal; (8) cell cycle length; (9) transcriptomes of embryonic mouse and fetal human neocortical germinal layers and specific progenitor subpopulations.

Recent insights into the cell biology of CSPCs, molecular pathways and factors, and their role in neocortex expansion in development and evolution will be presented.