Abstract

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DNA nanotechnology for modulating the growth and development of neurons

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Abstract

Late prenatal growth, early postnatal growth, and layering of the neocortical neurons (NC-Ns) play determining roles in the development of the cerebral cortex (CC). Here, we systematically explore the interactive role of neuronal surface receptors (NSRs) on cytoskeleton activation (CA) and the piconewton (pN) force generation (P-FG) and their influence on the proper development, growth, and functioning of neurons using a designed DNA nanomechanical device (DNA-NMD). This DNA-NMD, functioning as a molecular tension probe (MTP), can be used to selectively bind the different NSRs (β-NGFR, Reelin, and Integrin) to mono-, bi-, and trispecifically activate the receptors on the NC-Ns surface for imaging and calculating the P-FG involved in various processes. Measurements in vivo on the brain of newly born Institute of Cancer Research mice (early postnatal) or in vitro after extracting neurons from the fetal brain of pregnant Institute of Cancer Research mice (late prenatal) reveal that there are augmented interactive roles of the β-NGFR with Integrin and Reelin receptors (RR) on the CA and P-FG, resulting in enhanced directional migration of the neuronal endings (M-NEs), layering, and the somal terminal translocation (S-TT) followed by early postnatal growth.

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Biography

Dr. Mirza Muhammad Faran Ashraf Baig is a registered Pharmacist and currently a post-doctoral fellow at the Faculty of Dentistry, The University of Hong Kong under the supervision of Professor Chengfei Zhang. He received his Doctor of Pharmacy (PharmD) and MPhil (Pharmaceutical Chemistry) degrees from the Faculty of Pharmacy, Bahauddin Zakariya University (BZU), Multan, Pakistan, and a Ph.D. degree from the School of Chemistry and Chemical Engineering, Nanjing University (NJU), China under the supervision of Prof. Dr. Xing-Hua Xia. His research work is about Biomedical Engineering, Mechano-Pharmacology, Polymers, Material Chemistry, DNA Nanotechnology, Developmental Biology, Neuroscience, Nano-Therapeutics, Bio-sensing, Bio-imaging, Diagnostics, Biotechnology, Biophysics, and Biochemistry. His current research focus is designing DNA based novel functional & bio-active nanomaterials to apply in Restorative Dentistry, Oral Microbiology & Oncology, Regenerative Therapeutics, Stem Cells Research, Drug Delivery, and Molecular Pharmaceutics. He published in the top journals e.g Nano Letters (ACS, USA), indexed in Harvard University Library Press.

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