

# A DNA Nanodevice Simultaneously Activating the EGFR and Integrin for Enhancing Cytoskeletal Activity and Cancer Cell Treatment

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## Abstract

Cell-surface receptors (e.g., EGFR and integrin) and their interactions play determining roles in signal transduction and cytoskeletal activation, which affect cell attachment/detachment, invasion, motility, metastasis, and cell-cell signaling. For instance, the interactions between the EGFR and integrin ( $\alpha 6 \beta 4$ ) may cause increased mechanical force and shear stress via enhanced cytoskeleton activation. Here, we design a DNA nanodevice (DNA-ND) that can simultaneously target the EGFR and integrin receptors on the caveolae. The piconewton (pN) forces in response to the EGFR-integrin coactivation can be sensed upon the unfolding of the DNA hairpin structure on the side arm of the device via changes of the fluorescence and plasmonic signals. We find that simultaneous activation of EGFR-integrin receptors causes enhanced signal transduction, contractions of the cells, and initiation of the biochemical pathways, thus resulting in a change of the cell division and endocytosis/exocytosis processes that affect the cell proliferation/apoptosis. The DNA-ND further enables us to visualize the co-internalization and degradation of the receptors by lysosomes, providing a novel approach toward bioimaging and mechano-pharmacology.

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## Biography

Dr. Baig, MMFA is a registered pharmacist, and currently a post-doctoral fellow (PDF) at the Faculty of Dentistry, The University of Hong Kong, under the supervision of Professor Dr. Chengfei Zhang. He received his Doctor of Pharmacy (PharmD), and MPhil (Pharmaceutical Chemistry) degrees from the Faculty of Pharmacy, Bahauddin Zakariya University (BZU), 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. During his PharmD research, he worked on a clinical trial in the Cardiology Ward of Nishtar Hospital, Multan, Pakistan (2009-2011). Later, he worked as a "Research Assistant" on a breast cancer project in the Department of Molecular Biology & Biotechnology, BZU, Pakistan (2011-2012). His task was to analyze genetic polymorphism in the DNA extracted from the WBCs of the freshly collected blood samples. Then, he

joined "Novartis Pharma, Pakistan" as a "Medical Information Officer" in the cardiovascular group (2012-2015) and won the "National Performance Award" in 2015. After that, he switched to academia in 2015 and worked as a "Lecturer of Pharmacology and Biochemistry" in Multan Medical & Dental College, University of Health Sciences, Lahore, Pakistan. He also taught Pharmacology and Physiology as a visiting lecturer at China Pharmaceutical University, and Nanjing Medical University in summer 2019. His MPhil research was focused on DNA Nanotechnology, Polymers, Material Chemistry, Drug Delivery, Biomedical Engineering, and Molecular Pharmaceutics. During his PhD, he won an excellent PhD student award in 2019 and worked on MechanoPharmacology, Advanced DNA NanoTherapeutics, Developmental Biology, Neuroscience, Biophysics, Bio-sensing, Bio-imaging, and Diagnostics. Currently, his research focus is designing DNA-based novel functional & bio-active nanomaterials to apply in Restorative Dentistry, Oral Microbiology & Oncology, Regenerative Therapeutics, and Stem Cells Research.

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