

# Molecular Engineering and Translational Research

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Advances in our understanding of molecular structure, dynamics, and functional mechanisms open remarkable possibilities to rationally design novel biological molecules with desired functions. The applications of such designed molecules are limitless, ranging from regulators of cellular behavior, sensors, therapeutic agents, and vaccines. Such applications allow us to translate fundamental biological and physical knowledge to clinical applications and research. Here we describe multiple methodologies developed in our laboratory: molecular modeling and drug discovery tools. Using these methodologies, we describe several applications that reach translational potential to clinical studies and therapeutics. Specifically, we will describe our recent successes in designing novel HIV and COVID-19 vaccines, nucleic acid nanoparticles (NANPs) capable of immunostimulation, and developed means for storage and handling these NANPs.