Abstract

Development of biopharmaceuticals is currently the most active research area, and about 80% of all biologics are protein and peptide-based drugs, and about 15% are gene-based drugs including mRNA vaccines. Despite the growing need for biopharmaceuticals, there are significant hurdle in actual clinical applications. Since general protein and gene drugs cannot pass through the cell membrane and enter the cytoplasm by themselves, drug delivery systems such as liposomes and lipid nanoparticles are required. However, even in the case of a drug that enters the endosome within the cell, only about 1 to 5% of the drug can escape the endosome and be delivered into the cytoplasm, so its usage is extremely limited. Accordingly, in order to solve the problem, it is necessary to develop a drug delivery platform that can effectively deliver the biopharmaceutical into the cytoplasm (intracellular delivery). Through this, the research on intracellular targets, which has been limited to synthetic drug, can be expanded and applied to overall biopharmaceuticals including protein drugs and gene therapies.

In this seminar, I will introduce two intracellular delivery platforms. One is about toxin-based intracellular delivery platform constructing endosome-specific pore, which induce endosomal escape of drug. The other topic is about chemically modified oligonucleotides that can be constructed inexpensively and simply by PCR. Chemically modified oligonucleotides can pass through cell membranes, so this can be applied for enhanced gene delivery such as aptamers or antisense nucleotides. These approach using proteins or oligonucleotides will be able to present a new paradigm for intracellular delivery of biopharmaceuticals in the near future.