Cancer is highly lethal and a main cause of death in the world. Although the development of cancer therapies has increasingly attracted scientists’ attention in recent decades, cancer treatments have not yet been improved to a satisfactory level. There are currently four therapeutic options for cancer treatment: surgical resection, chemotherapy, radiation therapy, and immunotherapy, either individually or in combination. Among these, traditional chemotherapy is most frequently used to treat various types of tumors.

Chemotherapeutic agents are expected for effective medicine according to recent advances in various techniques in the fields of biotechnology and life sciences. However, their practical use tends to be limited due to serious harmful side effects on healthy tissues. Therefore, targeted drug delivery systems (DDS), defined as systems enabling the spatiotemporal control of drug distribution in the body to improve both efficacy and safety, have been developed to treat cancer.

This Current Topics of the Chemical and Pharmaceutical Bulletin aims to reflect recent progress in DDS for cancer therapy. In selecting from current research, I have focused on several different types of cancers involved in the development of DDS carrier strategies.

The first review, by Dr. Hidemasa Katsumi et al., “Bone-Targeted Drug Delivery Systems and Strategies for Treatment of Bone Metastasis,” addresses cancer treatments with delivery difficulties. Bone metastases can cause high morbidity and mortality, especially in patients with prostate and breast cancers. At this moment, the delivery of most anticancer drugs to bone is limited because of lower blood flow to the bone compared to other organs. The authors reviewed recent challenges in the development of bone-targeted delivery systems, and strategies for the treatment of bone metastasis. Future development of novel drug formulations was also discussed in order to optimize targeted drug delivery in the treatment of bone metastasis.

The second review, entitled “Recent Strategies for Targeted Brain Drug Delivery,” was contributed by Koki Ogawa, Naoya Kato and Professor Shigeru Kawakami. The development of therapeutics against some cerebral diseases is difficult because the blood–brain barrier (BBB) or blood–brain tumor barrier (BBTB) prevents therapeutics from entering the brain. The authors provide an overview of recent strategies for crossing the BBB and BBTB by brain targeted DDS, and, in addition, evaluate methods of drug distribution in the brain. They also introduced the application of brain-targeted DDS for brain tumors, Alzheimer’s disease, Parkinson’s disease and stroke.

Next, I focused on refractory diseases such as pancreatic and lung cancer. The third review, entitled “Drug Delivery System for Refractory Cancer Therapy via an Endogenous Albumin Transport System,” was written by Dr. Yu Ishima et al. In the cancer microenvironment observed in refractory pancreatic cancer, many cell types, such as cancer cells, immune cells and vascular endothelial cells, are irregular; hypoxia and insufficient nutrition bring diversity to the phenotypes of these cells. The authors focused on the high tumor accumulation of albumin, demonstrated via the enhanced permeability and retention (EPR) effect using S-nitrosated human serum albumin dimer. They also introduced a DDS strategy utilizing the endogenous albumin transport (EAT) system of tumor cells, and discussed its future development.

Dr. Tomoyuki Okuda and Professor Hirokazu Okamoto have summarized the fourth review, entitled “Present Situation and Future Progress of Inhaled Lung Cancer Therapy: Necessity of Inhaled Formulations with Drug Delivery Functions.” Lung cancer is one of the most common and serious types of cancer globally. The authors highlighted the present status and future progress of inhaled drugs for lung cancer therapy. This review includes an overview of available inhalation devices, pharmacokinetics, and outcomes in clinical trials so far. Moreover, it introduces novel formulation strategies based on DDS to achieve better anticancer efficacy and to attenuate pulmonary toxicity.

Finally, Dr. Shintaro Fumoto and Professor Koyo Nishida organized a review entitled “Co-delivery Systems of Multiple Drugs Using Nanotechnology for Future Cancer Therapy.” Targeted co-delivery systems can simplify clinical procedures and improve a patient’s QOL. Despite the relative difficulty in co-delivery of drugs with different properties, some researchers have succeeded in the development of such co-delivery systems. The authors reviewed various co-delivery systems for multiple drugs, including small molecule drugs, nucleic acids, genes and proteins.

I greatly appreciate all of these authors and contributors for their efforts in organizing this Current Topics on Recent Progress in Drug Delivery System for Cancer Therapy. I believe that the studies covered in this Current Topics will provide useful information for the development in clinical applications of cancer therapy DDS.

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