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Editorial

Controlled delivery systems are the cornerstone of advanced therapies and vaccines: An Asian perspective

The field of controlled release has evolved rapidly over the past few years, covering nearly all emerging healthcare technologies from personalized medicines, gene editing, photodynamic and photothermal therapy, disease diagnostics, nucleic acid and protein therapy, tissue engineering and regeneration, imaging-guided surgery, to vaccines and immune therapy. Controlled delivery systems have become the cornerstone of advanced therapies and vaccines against practically all life-threatening diseases including cancers, viral and bacterial infections, neurological and cardiovascular diseases, and autoimmune diseases. The approval and wide application of the first two vaccines against COVID-19, both of which are based on mRNA [1], would not have been possible, without safe and effective vehicles for mRNA delivery. The capability of lipid nanoparticles to preferentially deliver small interfering RNA (siRNA) specific to transthyretin mRNA to hepatocytes enabled the clinical development of the first effective treatment, patisiran (ONPATTRO™), for polyneuropathy of hereditary transthyretin-mediated amyloidosis (hATTR), which was also the first siRNA therapeutic to receive regulatory approval [2]. The nanomedicine CPX-351 that co-delivers two small molecule drugs, cytarabine and daunorubicin, at a fixed molar ratio of 5:1 has been approved as an advanced chemotherapy for older patients with high-risk/secondary acute myeloid leukemia [3]. It should be noted that the above clinical breakthroughs were made possible by delivery in lipid nanoparticles and liposomes, which are simple and relatively safe systems. Further and greater advances could be achieved if there were more functional and innovative controlled delivery systems. Many clinical needs are not possible to address with current delivery technologies.

The research and development on controlled delivery systems has been and will remain one of the hottest and most inspiring and impactful areas. The researchers from Asian countries including Korea, Japan, China, and Singapore have been making increasingly overwhelming and profound scientific and technological contributions to this field. The *Journal of Controlled Release* (JCR) is a top forum for the dissemination of cutting-edge research and innovations in the controlled delivery field. With the wide and enthusiastic support from our authors, reviewers, editorial board members, and readers, JCR expects an estimated impact factor of 9.4 in the 2021 release of Journal Citation Reports from Clarivate. Endorsed by Prof. Kinam Park, former Editor-in-Chief, and Prof. Yu-Kyoung Oh, Deputy Editor-in-Chief of JCR, I have the honor and privilege to compile an Asian Special Issue (Asian SI) to showcase advancements in delivery science and technology by top researchers and rising stars in Asia. This Asian SI includes 53 manuscripts, from which we can derive the following trends in drug delivery:

1. Cancers are a major focus of controlled release research [4–18], while attention is also paid to diabetes [19–21], wound healing [22], bacterial and viral infections [23–27], inflammation [28,29], and tissue regeneration [30].
2. Nanosystems and hybrid nanosystems based on e.g. metal-organic framework [19,31], liposomes [5,24,32], micelles [33–36], polymersomes [16,37], exosomes and extracellular vesicles [17,38,39], nanosheets [40], serum proteins [41], magnetic nanoparticles [13], polymer/protein-drug conjugates [42,43], nanogels [44], upconversion nanocomposites [45], and polyion complexes [46] are the main platforms for the development of targeted therapies, diagnostics, and theranostics.
3. Targeted therapy [5,15,32,47], imaging-guided therapy [4,7,10], immunotherapy [17,18,39,48,49], and combined therapy such as photodynamic/immunotherapy [9,39], photothermal/immunotherapy [13], and chemo/photodynamic therapy [16,31] represent the future treatment modalities for a range of challenging diseases including cancers, infections, and inflammatory diseases.
4. How to cross blood-brain barriers and deliver therapeutics to glioblastoma and brain metastases [14,15,50], how to enhance tumor accumulation and achieve deep tumor penetration in particular for pancreatic cancers [39], how to eradicate cancer metastasis [50,51], and how to kill drug-resistant cancer cells and bacteria [12,27,50] are unresolved and important problems to address.
5. In addition to nanosystems, functional polymers [26,34,52], hydrogels and hydrogel patches [22,23,30,43], bacteria and bacterial derivatives [53], polymeric microneedles [21], and rhodamine isothiocyanate derivatives [54] are developed for different applications such as cytoplasmic protein delivery, bone cement additives, wound healing, bone formation, sustained release of antibiotics, transdermal drug delivery, and disease diagnosis.
6. Smart systems responsive to tumor microenvironment, inflammatory microenvironment, and distinct biological or external stimulus such as pH [9,19,24], photo [22,45], glucose [19], and redox [12,55] are developed to better modulate drug release behavior and thereby improve therapeutic performance.
7. Innovative strategies are developed to tackle systemic [15,47], oral [6,20,35,56], local [7,9,18] and transdermal [21] delivery barriers for distinct drugs including chemotherapeutics, proteins, and nucleic acids (e.g. siRNA, miRNA, and mRNA).

Please note that this Asian SI is far from comprehensive and presents only a fraction of the exciting research being undertaken by our colleagues. I hereby extend a cordial invitation to all colleagues and friends

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in the controlled release community to publish your fabulous work in JCR, which is the best and most appropriate forum to exchange your innovative ideas and accomplishments on drug delivery science and technology.

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