Editorial

Personalized Medicine: Focusing on Translational Research

Molecular and personalized medicine is the future for patient management. Translational research is the bridge between basic science discoveries and clinical patient management. In this special topic issue of *Current Molecular Medicine*, we have invited leading experts from many countries to contribute review articles on a wide variety of topics in translational research.

Most of the review articles in this special topic issue have focused on imaging and therapy of cancer. One of the most extensively studied targets over the last decade was integrin $\alpha_v\beta_3$, a cell adhesion molecule that plays pivotal roles in cancer development and metastasis. In the first article of this issue, Drs. Liu and Wang gave a comprehensive overview of the various strategies that have been used to optimize and accelerate integrin $\alpha_v\beta_3$-targeted radiotracers towards clinical translation. Many of these tracers have already entered clinical investigation, which can play multiple roles in future personalized management of cancer patients.

In the next review, Dr. Heskamp and co-workers focused on tumor receptor imaging in breast cancer. In addition, the potential roles of molecular imaging in the development of new therapeutic agents are also discussed. Among the many proteins that are overexpressed in various breast cancer subtypes, one of the most well-studied is the human epidermal growth factor receptor 2 (HER-2). In the next article by Dr. Wang and co-workers, antibody-based imaging of HER-2 is summarized and discussed. Recently, some of these agents for HER-2 imaging have moved into the clinic with exciting results and promising future.

CXCR4, up-regulated in a wide variety of cancer types, has also gained tremendous attention over the last decade. The current status of imaging CXCR4 with fluorescence, bioluminescence, positron emission tomography (PET), and single-photon emission computed tomography (SPECT) techniques are comprehensively reviewed in the next article. Big strides have been made over the last several years in the development of CXCR4-targeted imaging probes, and clinical translation and investigation of these agents are eagerly awaited.

Quantum dots (QDs) have attracted tremendous attention over the last two decades. The superior properties of QDs over conventional organic dyes make them attractive labels for a wide variety of biomedical applications, however concerns over potential toxicity of QDs remain a major hurdle for potential clinical translation. Tremendous research effort has been devoted to surface modification and functionalization of QDs to make them versatile probes for biomedical applications, and significant progress has been made over the last several years. The next review article provides a comprehensive summary of the current status of the synthesis, modification, bioconjugation, and various applications of QDs for *in vivo* targeted imaging.

Image-guided surgery has gained much attention over the last few years. The next review written by Dr. Choyke and co-workers outlined the history and development of molecular imaging probe design and provided an overview of preclinical/clinical models employing molecular probes for *in vivo* imaging of urogynecologic cancers. Meanwhile, the article contributed by Dr. Tian and co-workers focused on the recent translational studies of optical molecular imaging for personalized medicine. The authors also discussed the challenges and future development of optical imaging agents for clinical translation.

Many cancer therapeutics act by damaging the DNA of tumor cells. The phosphorylated histone γH2AX is generated early in the response to DNA double strand breaks. Dr. Vallis and co-workers provided an excellent summary in the next review to assess the potential of γH2AX as a practical and clinically useful biomarker of tumor and normal tissue responses to therapy. For cancer chemotherapy, platinum-based agents that can bind to DNA are commonly used. In the next article, Dr. Zhang and co-workers reviewed these platinum-based agents with respect to their structure, mechanism of action, and strategies used to improve efficacy for cancer treatment.

Cancer nanomedicine is another vibrant area in translational research. Among a wide variety of nanomaterials that have been investigated to date, two relatively new classes of exciting nanomaterials with tremendous potential for biomedical applications are upconversion nanoparticles and zinc oxide (ZnO) nanomaterials. In the next article, Dr. Shi and co-workers gave a comprehensive summary on the use of functionalized upconversion nanoparticles for biological imaging and therapy applications. Furthermore, future research directions, obstacles ahead, and other potential uses of functionalized upconversion nanoparticles in translational research were discussed. For ZnO nanomaterials, one of the most important features is low toxicity and biodegradability. The investigation of ZnO nanomaterials for biomedical applications was summarized in the next review, such as molecular imaging, drug delivery, gene delivery, and biosensing.

Although the majority of review articles in this special issue are focused on cancer, translational research is by no means limited to oncology. Stroke caused by carotid atherosclerosis is a leading cause of mortality and disability in the developed world. Since inflammation is a key feature which predicts whether a plaque is likely to rupture and hence can lead to stroke, Dr. Owen and co-workers focused their review on the assessment of carotid inflammation by PET. Non-invasive PET imaging to identify high risk plaques will allow clinicians to target intensive medical or surgical treatment to high risk patients.

Topics on translational research can easily fill several books and we sincerely hope that this special topic issue will provide a snapshot of this highly interdisciplinary and fertile ground of research. Fast and broad applications of newly developed agents/tools in future clinical investigations will be needed for the maximum benefit of patients. We are deeply grateful to all contributors of this special topic issue for their tremendous effort in writing these exceptional review articles on a broad range of areas in translational research, which we believe will be an invaluable resource for scientists, students, clinicians for many years to come.

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