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Editorial

Introduction to special issue on single cell analysis (Part II)

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We welcome the readers to the special issue on single cell analysis (Part II), which highlights recent progress in the development of single-cell optical analysis techniques and their applications in biological discovery, disease diagnosis, and treatment. The first part of this special issue was published in

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March 2023, which includes three review and five research articles.[1] It is exciting for us to receive some positive responses from our peers who have continued to contribute five additional articles to form the single cell analysis (Part II). We believe that these papers of this special issue will provide a better understanding of single cell analysis.

The skin is the largest organ in humans and skin diseases are common. Therefore, it is crucial to develop an objective, reliable, accurate, non-invasive, and easy-to-use diagnostic method for skin diseases. Raman spectroscopy is a highly specific imaging technique, which is sensitive, even to the single-cell level in skin diagnosis. Min Wu, Beibei Gao, and Xunbin Wei contributed a review on recent advances in Raman spectroscopy for skin diagnosis.[2] Cancer cells dysregulate lipid metabolism to accelerate energy production and biomolecule synthesis for rapid growth. Coherent Raman scattering (CRS) microscopy is capable of chemically selective, highly sensitive, submicron resolution, and high-speed imaging of lipid molecules in single live cells without any labeling. Shuo Zhang, Yexuan He, and Shuhua Yue reviewed the latest applications of CRS microscopy in the study of lipid metabolism in cancer.[3] *In vivo* flow cytometry (IVFC) is a new tool to monitor and count cells in real time for long durations in their native biological environment. A review from Mingyi Wang's group describes two main categories of IVFC, i.e., labeled and label-free IVFC. It focuses on label-free IVFC and introduces its technological development and related biological applications. Since cell recognition is the basis of flow cytometry counting, this review also describes various methods for the classification of unlabeled cells, including the latest machine learning-based technologies.[4]

Microfluidic systems have been widely utilized in high-throughput biology analysis, but the difficulties in liquid manipulation and cell cultivation limit its application. The work from Jiong Ma's group developed a new digital microfluidic (DMF) system for on-demand droplet control, and their results showed that the combined system can be applied for rapid single-cell sorting, cultivation, and analysis.[5] Fourier light-field microscopy (FLFM) uses a microlens array (MLA) to segment the Fourier plane of the microscopic objective lens to generate multiple two-dimensional perspective views, thereby reconstructing the three-dimensional (3D) structure of the sample using 3D deconvolution calculation without scanning. However, the resolution of FLFM is still limited by diffraction, and furthermore, it is dependent on the aperture division. In order to improve its resolution, a super-resolution optical fluctuation Fourier light-field microscopy (SOFFLFM) was proposed by Danni Chen's group.[6]

As the guest editors of the special issues on single cell analysis, we really appreciate the unique opportunity JIOHS has provided to highlight this important topic. Most importantly, we show our gratitude to all authors for their valuable knowledge and experience.

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