Preface

Cell separation, which was once limited to merely being a basic technique for fractionating different cell populations, has come a long way in the last two decades. New, advanced and more specific and selective techniques have emerged as the demand for isolating a specific cell type for various biological applications has increased. Efficient and cost-effective techniques for fractionation and isolation of target cell types are necessary to provide pure cell populations for diagnostics, biotechnological and biomedical applications. One can see a considerable need, both in biomedical research and in diagnostic medicine, for the specific separation of a discrete population of cells from a mixture. For example, in the field of tissue engineering, isolation of stem cells from tissues or organs is of particularly great importance. Moreover, understanding cell developmental pathways becomes increasingly significant as diagnosis and treatment of diseases turns more to the molecular level. The diagnosis of cell-related diseases requires methods of detection, isolation and the analysis of individual cells, regardless of their relative content in the tissue. Since cell-based therapies now turn towards more realistic medical options, developing an effective separation system for large-scale cell separation has become challenging research goal for cell biologists and biotechnologists. The ideal technique should provide in a short time a good yield of cells with high purity while maintaining cell function. Despite the growing need for methods to separate cells into cell subpopulations, the existing cell-separation techniques still have some limitations when the desired degree of performance on a preparative scale is required. We will see more research focus in this direction in the future.

The traditional techniques of microfiltration, ultrafiltration and ultracentrifugation, which exploit differences in cell size, shape and density, have remained the workhorses despite low specificity and problems with scaling up. Flow cytometry, where the target cells are labelled with an immunofluorescent probe, is an accurate and routinely used method. With new developments in flow cytometry, one may more commonly see the availability of such a robust technique at affordable costs and efficient timescales. On the other hand, magnetic bead separation technology has gained popularity within the fields of cell biology and medical microbiology and new products have appeared in the last decade that have simplified the cell-separation technology arena. Selective

separation of different cell types is now possible by using specific antibody coated magnetic particles that interact with the cell surface markers. It is felt that despite expansion of techniques and an increase in the scientific and technological knowledge associated with it, few books have been dedicated to reviewing the current status of cell-separation technologies.

This special volume on cell separations discusses fundamental and applied aspects of the analytical and preparative cell-separation technologies. The aim is to enlighten the reader with the new developments in cell-separation technologies and at the same time provide sufficient knowledge with other existing and more commonly used techniques. The volume is comprised of contributions from subject experts from both academia and industry, focuses on the research and commercial aspects of cell-separation technology, and provides readers with broader choice. Unlike protein separation, the major challenge in cell separation has been the recovery of the cells in viable form after they are bound to the separation matrix, as cells bind more strongly through multipoint attachment. This is an important focus of the present work and one we believe will provide new insight to researchers in this field.

The first introductory chapter, *Methods in Cell Separations*, gives a brief overview of the most commonly used cell-separation methods, which are discussed in terms of cell fractionation yields, throughput and purity. The chapter gives a brief introduction to some of these technologies, which are further discussed in more detail in separate chapters. The most important aspect of the introductory chapter is the updated information regarding commercially available reagents and methods for cell separations and the companies producing them. The remaining chapters in the volume provide the reader with information on each of the methods described, ranging from the basic technical principle of a method to its applications. The advantages and limitations of each technology reviewed are discussed, providing the reader with a critical view of each method and its applications. The introduction of cryogels as new tool for cell separations will provide readers with new ideas of their applications and this will certainly help researchers with the design of their own cell-separation projects. In conclusion, we believe the volume brings to the attention of researchers at all levels the variety of methods available for separating viable populations of cells and addresses the needs and challenges for future research in this growing field.

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