

BOOK REVIEW

Large Scale Cell Culture Technology

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The increased need for large scale cell culture has led to many efforts to improve traditional technology. Written by the leaders in the field, this book explores the major approaches to systems for large scale animal and plant cell culture. Various methods are described in detail in terms of principles, equipment, and results so that informed comparisons and evaluations can be made. Two driving forces for these recent developments are the surface-dependence of some animal cells and the high shear sensitivity of both animal and plant cells, and these problems are the main issues addressed in the approaches. Another driving force for large scale cell culture is the relatively high cost of nutrients, which is less emphasized in this book.

Ten topics are covered in five sections entitled fermentation, encapsulation, bioreactors, plant cell culture, and regulatory considerations. The first three chapters illustrate the use of relatively standard fermentation equipment for mammalian cells grown either directly in suspension or on the surfaces of small beads that can be readily maintained in suspension. Technical aspects and practical successes are described for the monoclonal antibody production with airlift fermentors and with stirred tanks, and for the application of microcarrier culture systems to grow anchorage-dependent cells.

Reflected in the next two chapters is a major innovation of recent years, the encapsulation of cells in small beads or spheres and the immobilization of cells in different forms of porous matrices. One approach shown is microencapsulation with semipermeable membrane that facilitates the growth of hybridoma cells to high densities and simultaneously partitions the antibody to permit efficient, easy purification. Another approach described is to entrap the cultured cells in agarose beads that pro-

protect the sensitive cells from mechanical stress and thus enables various types of reactors to be used.

The three chapters in the bioreactor section present three different ways for providing for high cell density perfusion reactors applicable to both adherent cells and suspension cells. The automated hollow fiber system offers solutions to such scaleup problems as gradient formation, anoxia, and microenvironment cytotoxicity. The continuous cell culture with fluidized sponge beads enables the animal cells to be cultured in a systematic, technologically-definitive, and inexpensive fashion. The perfusion system based on the rigid ceramic matrix is applicable to a broad range of animal cell types and modes of production, without such problems as shearing, foaming, and aggregation.

The plant cell culture section includes one chapter reviewing the types of plant products and processes considered for large scale application. Special considerations required for plant cell culture in contrast to microbial culture are given. Since the use of cultured plant cells has not been as commercially successful to date as animal cell culture, the methods have not been developed to the same extent.

Because of the safety risk associated with the development of biologicals from cell culture, the final section of the book incorporates a chapter focusing on current considerations involved in the production from cell culture. Historical lessons and the impact of the system chosen for production are also reviewed.

The various topics are on the whole well and tightly organized. All the chapters on animal cell culture contain a relatively brief review of the technique and its scope, followed by practical details, survey of applications and potential uses, and, finally, a concise summary or conclusion. Since the authors are all actively involved in technique development, the presentations are relatively detailed in methodology. Readers may find them useful both as reviews and as research papers. Extensive references are given at the end of each chapter, yet not all of them have full titles. There are few typographical errors in the book.

The subject of this book is to provide various alternatives to choose from for large scale cell culture, although in some chapters the discussion relies heavily on the author's own work and may leave the impression that the technique described is the only best to choose. However, this is not a serious problem and the readers should be able to judge for themselves. In conclusion, this book will be of interest and utility to students and research workers in the area of large scale cell culture by providing them a broad view of the practical problems and the different solutions that have been developed.

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