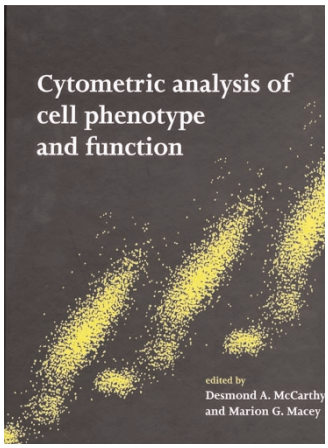
The role of cytometry in research and patient care



Cytometric analysis of cell phenotype and function
edited by D. A. McCarthy and M. G. Macey
Cambridge University Press, 2001
Hardcover, £95/$140

Rafael Nunez

Cytometry is used for assessing and quantifying cells and cell components by utilizing sophisticated optical and electronic hardware. Although cytometry measures one cell at a time, the fastest equipment can actually process thousands of cells in a few seconds. Cytometry can be used to count, and even distinguish, cells of different types in a mixture by assessing their structural features. Therefore, cytometry has great advantages over traditional optical methods used to quantify cells, as it allows one to analyse more cells in a fraction of the time. In addition, cytometry and cell sorting with cytometers have been very powerful tools for advancing diverse research fields and even influencing the handling of patients in clinical areas.

In the early 1970's, flow cytometers were initially used for blood cell counts. Their ease of handling and their reliability rapidly popularized their use in clinical laboratories. The newest and most sophisticated instruments employ lasers and detectors of fluorescence, which expand the utilization beyond clinical laboratories. Cytometers can be used as analysers for cell evaluation and/or as sorters for cell evaluation and separation. The world-wide utilization of cytometry in biomedical sciences is demonstrated by the increasing number of publications containing cytometric data. About 51765 citations containing cytometry information have been compiled by Medline up to December 2001.

Cytometers (analyser and sorters) are found in all leading biomedical research institutions and universities, where they are used for performing tasks that require analytical precision and high throughput. Cytometers also have a key role in hospital and medical centres world-wide, where they are widely used for diagnosis and clinical research. For example, they have been utilized for assessing: ploidy of cells, cell cycle and surface analysis of cancer cells; immunophenotyping of lymphomas and leukaemias (aiming to define diagnostic and prognostic value), and the monitoring of CD4 lymphocyte levels in the blood (cytometry is the method of choice for follow up in the progression or treatment response of AIDS patients). In addition, sorting and high-speed sorting of very rare cell populations, such as stem cells, using cytometers is becoming increasingly important.

In brief, *Cytometric analysis of cell phenotype and function* is an up-to-date book that is useful for everybody working in the cytometry field, as well as for those with a more general interest in biomedical sciences.

Cytometric analysis of cell phenotype and function, edited by D.A. McCarthy and M.G, Macey, extensively reviews the basic principles of cytometry and sample preparation. In addition, it provides key information about the principles of fluorescence and utilization of fluorochromes. The utilization of antibodies coupled to fluorochromes in cytometric applications is well covered by the authors and the addition of a table with an extensive description of the 247 cluster of differentiation antigens (CD) brings clarity to the leukocyte cell surface field. The chapter 'immunophenotypicanalysis of leukocytes in diseases' is full of tables and diagrams that will help clinicians assessing leukaemias and lymphomas.

The role of cytometry in assessing the binding to surface receptors of viruses, diverse proteins or cell–cell interactions is also extensively discussed in three chapters. Intracellular components can also be reported with this method by using fluorescent probes and cytometers. For example, measurement of total DNA per cell will allow cell cycle analysis. Also, cytometric determination of newly synthesized DNA or identification of specific nucleotide sequences in DNA or mRNA can be accomplished by cytometry. The authors dedicate two chapters to these topics.

Cytometry also measures rapid changes in intracellular free calcium, membrane potential, pH and free fatty acids. It can also be used for measuring the metabolic status of cellular membranes and to study mitochondrial functionality. The authors also cover these subjects very well.

Cytometry involves the sophisticated handling of fluids and pressure, complex laser beams and optics, very sensitive electronic detectors, analogue to digital converters, and high capability computers that demand very high standards of quality in the performance of any measurement. The authors provide a chapter discussing the subject of quality control on cytometry.

However, they only deal with the sorting subject in a very short chapter. Sorting applications have evolved from obtaining a few cells to complex applications that select cells for single cell analysis and/or collect the bulk of cells with a unique characteristic for analysis or transfer into a recipient.

Current and future developments in the cytometry field are commented on in the last chapter. The authors also provide the reader with an extensive list of useful internet sites that are very helpful for the researcher. In brief, *Cytometric analysis of cell phenotype and function* is an up-to-date book that is useful for everybody working in the cytometry field, as well as for those with a more general interest in biomedical sciences. □

Rafael Nunez is in the Memorial Sloan Kettering Cancer Center, 1275 York Avenue, Box 98, New York, NY 10021. USA.
e-mail: nunezr@mskcc.org