
Preface

As beautifully articulated by Dr. Richard Demay, cytology is a clinical practice that combines science with art. Cytology allows one to make a diagnosis based on changes of individual cells. The rapid turnaround time, minimum cost and resources needed (often just a microscope is needed), and noninvasive or minimally invasive method of obtaining diagnostic material are the major advantages for cytology. As such, morphology-based cytology has been and will likely continue to be in the forefront of clinical diagnosis and management of various human disease conditions, particularly cancer. While there are many great examples of cytology's instrumental role in patient care and clinical decision-making process, probably the most important one is cytology's contributions to cervical cancer screening. The combination of Pap smear-based diagnosis and colposcopy-based management has helped to drastically decrease cervical cancer incidence and mortality in the screened population.

However, there are indisputable limitations of a morphology-based cytology practice. Morphologic evaluation is not sufficiently capable of determining if a cell harbors the particular genetic or epigenetic changes that are the basis for targeted therapeutic drugs. In an era of precision medicine where more therapies and management schemes are geared toward specific molecular changes in disease processes, additional molecular analysis must be incorporated into a morphology-based cytological diagnostic work-up.

Fortunately, cytologic material has a distinct advantage over formalin-fixed paraffin-embedded tissue for molecular analysis,

such as single cell based next generation sequencing (NGS), quantitative multiplex protein or exosome analysis, or nanomechanical profile analysis. The advantage of cytologic material is that the cells are usually complete whole cells, rather than sections of cells. This in turn enables the precise quantitative determination of the biochemical or molecular changes occurring within a cell. With the advances of techniques such as NGS, microfluidic devices, and nanotechnology, this advantage will likely become more and more significant.

Molecular cytopathology is still in its infancy. This book is not intended to be inclusive of all the progress or publications in the field of molecular cytology to date, but rather to provide a reference or background that may help residents, fellows, cytotechnologists, and cytopathologists who are interested in molecular testing in cytologic specimens. In view of the rapid progress in this area, periodic updates will be necessary to reflect the most current developments.

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