



Advances in Pathobiology



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Editorial

In a short editorial like this, it is hard to present an overview of advances made in any medical specialty, except to highlight some areas that have made significant progress and discuss the importance of some subspecialties, that we feel are important, in the progress and growth of this discipline. Dr. Davidson in his abstract for the fourth edition of Recent Advances in Clinical Pathology defines this specialty “as that field of medical activity covering the application, through the instrumentality of the hospital laboratory, of its basic sciences to the clinical practice of medicine both in the diagnosis and in the treatment of diseases” [1-4]. He also discusses how this series were published over two decades to document the progress made in this subject. The first series was published in 1947, the second in 1951, and the third in 1960 [2]. The publication of the third series was delayed for nine years. The editor explains that the four main divisions of pathology have shown signs of growing apart in this period, and their practitioners have become more and more specialized [3]. The four divisions, which form the foundation of pathobiology are, bacteriology, biochemistry, hematology and histology. Wells et al. [2] writes in the abstract for these series that basic medical sciences have produced enormous body of information with varying degree of relevance to the practice of clinical medicine [2]. He further states that clinical pathologist is faced with the task of selecting and correlating bits of this knowledge from dozens of scientific disciplines and converting them, through the medium of laboratory technology, into useful roles in the diagnosis and treatment of diseases.

By the time I joined the Pathology Faculty, at the University of Minnesota in the early 70s, the Department of Pathology had already changed its name to Laboratory Medicine and Pathology. We had significant number of basic science faculty to explore and complement the findings of clinical pathologists. One fine evidence of changing times, is the organization of the World Congress on Pathology and Laboratory Medicine in Singapore this year (September 2018) around the theme “Pathology: Recent Advances in Diagnosis and Care”. The word “care” in the theme is important and expresses a new and novel role for the modern pathologists. As I have mentioned in earlier editorials, studying the mechanisms that underlie the disease is more important than just to focus on modifying the risks. Four mechanisms related to the disease are

metabolic alterations or disturbances, pathogenesis, morphogenesis, and clinical manifestations. In view of this need to understand the disease, at the University of Minnesota, the faculty organized a multidisciplinary graduate course under the new name, Pathobiology. Pathobiology is an interdisciplinary field devoted to both basic and applied sciences as they relate to the mechanisms of disease. The techniques of molecular biology, cell biology, and biochemistry are applied to define and characterize structural, functional, biochemical and metabolic abnormalities occurring at intercellular, sub cellular and molecular levels. Basic idea being, integration of new and emerging knowledge systematically, for understanding of an underlying disease process.

These early experiments and experiences led to the development of associated disciplines like infectious diseases, pharmacology, toxicology, immunology, molecular pathology, molecular oncology, computer sciences and bioinformatics. Advances made in all of these various specialties have contributed significantly to our understanding of the diseases and disease processes. For instance, the researchers at Rasmussen Center for the Prevention of Cardiovascular Disease (CVD) at the University of Minnesota, have been advocating for the last two decades management of the disease aggressively, rather than to focus on the management of conventional risk factors for CVDs [5,6]. They have developed a ten-point risk analysis for following the progression of the disease. Based on their experience they claim that there is no CVD without subclinical atherosclerosis and endothelial dysfunction (hardening of the arteries). Emerging technologies and integration of knowledge from basic and applied sciences have given the clinicians a great advantage in the early diagnosis and better management of chronic metabolic diseases. Using the latest noninvasive imaging technology, Valentin Fuster et al. [7] and associates at Mount Sinai Hospital, New York, have demonstrated that LDL-cholesterol is the main predictor for subclinical atherosclerosis and hardening of the arteries in 50% of the adult middle aged individuals, who were asymptomatic [7].

Imaging technologies have played a great role in the development of diagnosis of early stages of diseases. We see this not only with the use of high-end imaging techniques, but also in the general pathology laboratories. Take for instance, the great advantages of the ability to digitize images from glass slides in any modern pa-

thology laboratory. Whole slide imaging technology has been used to develop automatic tissue classification, disease grading and diagnostic tests [8]. Digital images of biopsy tissue specimens can be mined for images that can help in the prediction of disease status and its aggressiveness [9]. Talking about data mining and artificial intelligence, IBM Watson Health and Quest Diagnostics announced a launch of a new service that helps advance precision medicine by combining cognitive computing with genomic tumor sequencing. Memorial Sloan Katering will provide data from OncoKB, a precision oncology knowledge base to help inform individual treatment options for cancer patients. Memorial Sloan Katering clinicians and analysts are partnering with IBM to train Watson Oncology to interpret cancer patients' clinical information to identify individualized evidence-based treatment option. IBM's artificial intelligence platform is helping clinicians in many countries including India and China, for diagnosing cancer and providing evidence-based treatment options. In the field of Oncology, Watson is at work supporting cancer care in more than 150 hospitals in 11 countries, and a large, growing body of evidence supports the use of Watson in Healthcare.

Million-dollar question that comes to mind, while reading about the IBM-Watson and artificial intelligence, is can Watson be called a Pathologist or Oncologist? Can Watson replace a pathologist or Oncologist? Not really, a super computer, machine learning, or artificial intelligence can never replace the experience gained over the years by a clinician. They can only play a supporting role and make the life of clinicians easy. We have briefly traced the development of clinical pathology, pathobiology and medical pathology from the early days, when it was just limited to four disciplines, bacteriology, biochemistry, hematology and histology to the present day, when such demarcations of the disciplines are no longer important. Modern day pathology disciplines are

multidisciplinary and all inclusive of the various knowledge platforms. In view of this inclusiveness, there has been a great progress in our diagnostic capabilities; risk assessment, risk prediction and risk management strategies. We briefly mentioned about the integration of emerging technologies such as digitization, noninvasive imaging, 3D ultrasound imaging, data mining and artificial intelligence. However, the knowledge base for all these emerging technologies comes from evidence-based observations of basic and applied sciences..

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