Pathology Resident and Fellow Education in a Time of Disruptive Technologies

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KEYWORDS

• Resident education • Pathology • Laboratory medicine • Molecular genetics
• Informatics • In vivo microscopy • Cell therapy • Telepathology

KEY POINTS

- Resident education in pathology must be modified to accommodate new practice models and technologies, including genomics, informatics, digital pathology, therapeutic pathology, and in vivo microscopy.
- Implementation of a comprehensive genomics and personalized medicine curriculum is currently the most pressing need, while incorporation of digital pathology into training is the area that is currently advancing most rapidly.
- The future role for the practicing pathologist in informatics, in vivo microscopy and therapeutic pathology remains somewhat uncertain but these areas must be included in training if the disciplines are ever to be successfully incorporated into the pathologist's clinical portfolio.
- The need for expanded training in these new areas of pathology and laboratory medicine, while maintaining expertise in traditional areas of the discipline, raises serious questions concerning the future of generalist versus subspecialist pathology practice, the nature of training for pathologist-scientists, and the optimal training and certification approach for the discipline.

Even before the introduction of significant disruptive technologies to the practice of pathology, resident education in the discipline had already experienced fundamental changes starting at the beginning of the 21st century.[1] After a 20-year experiment of adding a credentialing year to all pathology training, the requirement was dropped for the residency class starting in 2002, which effectively moved the curriculum for training in both anatomic pathology (AP) and clinical pathology/laboratory medicine (CP) from 5 years to 4 years and for those training in AP-only or CP-only from 4 years to 3. One consequence of the shortening of core training was a marked increase in the number of residents taking subspecialty fellowships. This was driven in part by the demands of the hiring marketplace but was also made necessary by the explosion

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of subspecialty medical knowledge and the rapid introduction and continuing growth and evolution of major game-changing (and therefore fundamentally disruptive) technologies in genetics, informatics, digital pathology, therapeutic pathology, and in vivo diagnostics.[1–8] Residency programs have been forced to wrestle with the need to encompass training in these new areas while preserving nearly all of the traditional components of training. In the words of Lewis Carroll's Red Queen: "… it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"[9]

Subspecialty fellowship choices are therefore increasingly complex, including

- Accreditation Council for Continuing Medical Education (ACGME)-accredited programs with available American Board of Pathology (ABP) certification (blood banking, chemical pathology, cytopathology, dermatopathology, forensic pathology, hematology, medical microbiology, molecular genetic pathology, neuropathology, and pediatric pathology)
- ACGME-accredited selective pathology programs without available ABP certification (the most common being general surgical pathology, gastrointestinal/hepatic pathology, gynecologic/perinatal pathology, renal pathology, and bone and soft tissue pathology, but including many others)
- ABP certifiable subspecialties in a stage of evolution where there is not yet ACGME accreditation of appropriate fellowship programs (clinical informatics)
- Non-ACGME, non-ABP fellowships (often paralleling the selective pathology and ABP menus but also including areas such as immunology and transplantation)[2,10]

Reflecting the surge in new knowledge over the last 10 years, both molecular genetic pathology and clinical informatics have been added to the subspecialty certification menu of the ABP and the number of ACGME-sanctioned selective pathology training programs has increased by more than sixfold over that same time period.[2,11] There are now more fellowship slots than graduating residents.[2] It is estimated that fewer than 10% to 20% of graduating residents apply directly for jobs. The rest go on to seek fellowships, and fully 40% of graduating residents intend to complete more than 1 fellowship.[12] Only rare residents (approximately 5%) state that they are looking for a fellowship, because they cannot find a job[12]; hence these trends reflect a fundamental need for increased and broader training rather than some artifact of a mismatched job market.

These data, then, confirm that the discipline of pathology and laboratory medicine is evolving rapidly. The marketplace for residents/fellows and those hiring them is demanding increasing clinical expertise in the classical pathology subdisciplines as new technologies are introduced into those subdisciplines. Moreover, expertise in these new areas of pathology knowledge is needed to incorporate the disruptive technologies (eg, genomics, digital pathology, informatics) into standard practice. Further reflecting this, and despite the publication of recently updated comprehensive curricula in both AP and CP[13,14] as well as curricula in a number of rapidly growing subspecialty areas,[15–20] the College of American Pathologists and the Association of Pathology Chairs have recognized a critical need to further modify clinical training in an ongoing and dynamic fashion.[21] Finally, since 24% of graduating pathology trainees seek employment in academic medical centers,[12] one must also keep in mind the potential need to alter paradigms for meeting the training requirements of nascent physician–scientists,[22] as well as the training needs of full-time community practitioners.

This article will discuss the effects of the exploding knowledge base on 5 broad areas of resident training that have all been subject to the recent introduction of