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SPECIAL ARTICLE

A Suggested Molecular Pathology Curriculum for Residents

A Report of the Association for Molecular Pathology

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Molecular pathology is an essential element of pathology training. As more molecular tests have become available, there is an increasing need for pathology trainees to receive a strong foundation in molecular pathology. Appointed by the Training and Education Committee of the Association for Molecular Pathology, the Molecular Curriculum Task Force has developed a suggested curriculum in molecular pathology for residents. The foundations of molecular pathology are presented as a series of goals and objectives that residency programs can use to develop their educational programs. As pathologists continue to expand their roles to include regular clinical consultations in the realm of molecular testing, a strong foundation in molecular pathology and genomic medicine has become essential to the practice of pathology. *(J Mol Diagn 2016, 18: 153—162; http://dx.doi.org/10.1016/j.jmoldx.2015.10.006)*

In volume 1, issue 1, of *The Journal of Molecular Diagnostics*, the Training and Education Committee of the Association for Molecular Pathology (AMP) published a Special Report entitled *Goals and Objectives for Molecular Pathology Education in Residency Programs*.[1] General curricula for anatomical and clinical pathology published since that date have included recommendations that molecular pathology be included as an integral part of residency training.[2,3] Molecular diagnostic testing has become standard of care in many areas; hence, a strong working knowledge of molecular pathology is essential for all pathologists in training. Pathologists should be fluent in molecularly terms to effectively communicate with medical scientists and health care professionals. In addition, there is an increasing need for all medical professionals to be familiar with precision diagnostics and genomic medicine.[4,5] The Training and Education Committee of AMP formed the Molecular Curriculum for Residents Task Force for the purpose of developing a suggested curriculum that can be used by pathology residency programs as a framework to train residents in

The Molecular Curriculum for Residents Task Force is a task force of the Association for Molecular Pathology Training & Education Committee. The 2012—2014 Training & Education Committee consisted of Maria E. Arcila, Elizabeth Azzato, Devon Chabot-Richards, Christine A. Curtis, Caren Gentile, Harvey Greisman, Jill Hagenkord, Matthew Hiemenz, Giovanni Insuasti, Annette Kim, Jordan Laser, Rami Mahfouz, Rong Mao, Kathy A. Mangold, Benjamin Pinsky, Melinda Poulter, Paula Revell, Amrik Sahota, Ted E. Schutzbank (Chair 2012—2013), Rangaraj Selvarangan, Laura J. Tafe (Chair 2014), Sara Taylor, Shalini Verma, and Christopher D. Watt.

Standard of practice is not defined by this article, and there may be alternatives. See *Disclaimer* for further details.

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Table 1 Basic Molecular Pathology Goals and Laboratory Management

After completion of training, the resident should be able to:	Prerequisite	Essential	Recommended
Assist clinicians regarding appropriate test ordering/use (including appropriate sample selection and use of molecular testing at autopsy)		X	
Perform basic mathematical and statistical calculations used in the molecular laboratory, including, but not limited to, molarity, logarithmic and exponential conversions, regression, CIs, sensitivity, specificity, LOD, and linear range, etc	X		
Define the test designations RUO, IUO, ASR, IVD, and LDP		X	
Explain the regulatory requirements governing molecular diagnostic testing and compare the differences and similarities among the various test types (RUO, IUO, ASR, IVD, and LDP)		X	
Describe quality assurance and quality control for molecular testing and discuss any differences among the various test types		X	
Confirm acceptability of new reagent lots	X		
Explain unidirectional flow and effective strategies for contamination prevention, with respect to the appropriate design and workflow to reduce the risk of carryover contamination		X	
Explain the important legal, ethical, and social implications with regards to larger-scale or genomic testing and the ability to blind analytes to prevent unintended data analysis (eg, next-generation sequencing for cancer discovering an autosomal dominant condition)		X	
Be familiar with the College of American Pathologists checklist related to molecular pathology and explain ways to implement these recommendations in relation to testing practices, quality, safety, and other areas			X
Be familiar with the training requirements of qualified molecular pathology laboratory personnel and how they differ from other clinical laboratory settings			X

ASR, analyte-specific reagent; IUO, investigational use only; IVD, *in vitro* diagnostics; LDP, laboratory developed procedure; LOD, limit of detection; RUO, research use only.

molecular pathology. This document is the intended deliverable from the task force.

The curriculum presented here includes goals and objectives for residency training in molecular pathology and is intended to ensure a broad, foundational understanding of molecular pathology. It is not, however, expected that all residency programs would teach every item included. Some of these goals and objectives are taught in medical school or are included in undergraduate curricula but are included here to emphasize that pathology residents should understand this material whether or not it is taught during residency. In addition, this recommended curriculum for residents provides a foundation for further molecular genetic pathology fellowship training. Most of the goals and objectives may be applied to residency training in anatomical pathology only or clinical pathology only with only minor changes in emphasis to reflect the needs of the training program.

This suggested curriculum does not make specific recommendations regarding the Accreditation Council for Graduate Medical Education (ACGME) competencies or appropriate evaluation tools so that training programs may design their educational activities based on their strengths and the resources available to them. The ACGME and the American Board of Pathology have released a final version of The Pathology Milestone Project (*http://acgme.org/acgmeweb/Portals/0/PDFs/Milestones/PathologyMilestones.pdf*; last accessed March 19, 2015), which provides competency-based anatomical and clinical pathology milestones and gives guidance regarding suggested evaluation tools. Many of these milestones should be interpreted to incorporate molecular pathology, but none directly mention the subspecialty. As a result, individual training programs will need to determine how to best evaluate resident comprehension and mastery of molecular pathology within the context of the ACGME milestones.

The Molecular Curriculum for Residents Task Force established a series of major subject areas for molecular pathology. Subject matter experts were tasked with developing goals and objectives for each of these major topic areas. The entire task force then discussed and edited the items for each area. Immediately after the AMP 2012 Annual Meeting, the task force surveyed the AMP general membership and solicited public comment on the individual items. This feedback was used to revise and refine these goals and objectives.

The 10 major subject matter areas included for this curriculum are basic molecular pathology goals/laboratory management, basic concepts in molecular biology and genetics, technology, inherited disorders, oncology, infectious diseases, pharmacogenetics, histocompatibility and identity, genomics, and information management. Each subject area is described by a short narrative and a list of goals and objectives. Each item is