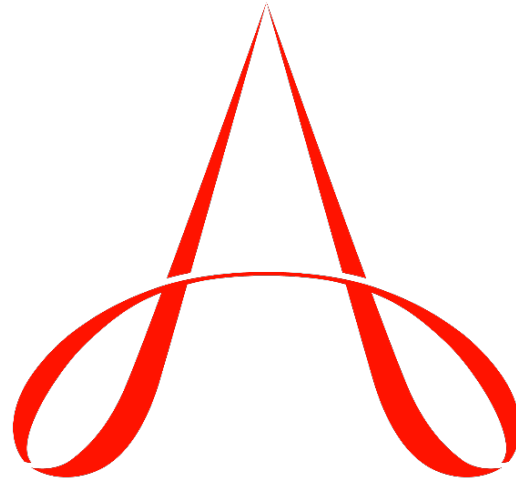




Supplemental Guide: Molecular Genetic Pathology



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Milestones Supplemental Guide

This document provides additional guidance and examples for the Molecular Genetic Pathology Milestones. This is not designed to indicate any specific requirements for each level, but to provide insight into the thinking of the Milestone Work Group.

Included in this document is the intent of each Milestone and examples of what a Clinical Competency Committee (CCC) might expect to be observed/assessed at each level. Also included are suggested assessment models and tools for each subcompetency, references, and other useful information.

Review this guide with the CCC and faculty members. As the program develops a shared mental model of the Milestones, consider creating an individualized guide (Supplemental Guide Template available) with institution/program-specific examples, assessment tools used by the program, and curricular components.

Additional tools and references, including the Milestones Guidebook, Clinical Competency Committee Guidebook, and Milestones Guidebook for Residents and Fellows, are available on the [Resources](#) page of the Milestones section of the ACGME website.

Patient Care 1: Quality Assurance and Quality Management	
Overall Intent: To actively participate in laboratory quality assurance and quality management and be able to lead the activity	
Milestones	Examples
Level 1 <i>Recognizes the importance of quality assurance and quality management</i>	<ul style="list-style-type: none"> • Reads and understands all aspects of the quality management plan for the laboratory
Level 2 <i>Understands the components of a comprehensive quality management plan</i>	<ul style="list-style-type: none"> • Lists and discusses various laboratory quality metrics and indicators
Level 3 <i>Actively participates in laboratory quality management and reviews data at designated intervals</i>	<ul style="list-style-type: none"> • Actively participates in laboratory quality management team meetings • Reviews laboratory metrics and indicators and begins follow up procedures for failed indicators
Level 4 <i>Recommends improvements in laboratory activities to improve quality assurance metrics</i>	<ul style="list-style-type: none"> • Formulates corrective action plans for various scenarios such as failed reagent quality control, temperature checks out of range, failed thermal cycler temperature checks, failed pipet calibration
Level 5 <i>Involved in local, regional, or national service in developing and/or implementing quality assurance programs and standards</i>	<ul style="list-style-type: none"> • Serves on a departmental/laboratory or institutional committee on quality assurance • Serves on a regional or national committee regarding laboratory quality/management issues
Assessment Models or Tools	<ul style="list-style-type: none"> • Direct observation • Rotation evaluations
Curriculum Mapping	<ul style="list-style-type: none"> •
Notes or Resources	<ul style="list-style-type: none"> • College of American Pathologists (CAP). Laboratory General Checklist. https://webapps.cap.org/apps/docs/education/OnlineCourseContent/2014/TLTM/GEN04212014.PDF. 2021. • CAP. Molecular Pathology Checklist. https://elss.cap.org/elss/ShowProperty?nodePath=/UCMCON/Contribution%20Folders/Dc tmContent/education/OnlineCourseContent/2017/LAP-TLTM/checklists/cl-mol.pdf. 2021.

Patient Care 2: Interpretation of Molecular and Genetic Testing Overall Intent: To effectively and independently interpret the results of molecular and genetic testing	
Milestones	Examples
Level 1 <i>Identifies the elements required to interpret the results of molecular testing:</i> <ul style="list-style-type: none"> ○ <i>Recognizes assay-specific quality assurance/quality control</i> ○ <i>Discusses clinical indication of test</i> ○ <i>Identifies elements of clinical report</i> 	<ul style="list-style-type: none"> ● Understands importance and role of positive and negative controls (e.g., "normal/wild-type" and no-template controls) ● Identifies College of American Pathologists (CAP) surveys relevant to a specific laboratory test menu ● Discusses result interpretation and methodology and test limitations
Level 2 <i>With substantial guidance, interprets the results of molecular testing:</i> <ul style="list-style-type: none"> ○ <i>Reviews/approves assay-specific quality assurance/quality control</i> ○ <i>Correlates indication and test results</i> ○ <i>Generates a clinical report</i> 	<ul style="list-style-type: none"> ● Verifies that quality assurance/quality control metrics fall within established acceptable limits for a given assay ● Runs controls fall within two standard deviations of the established control mean ● Understands indication for testing for a given clinical condition and verifies appropriateness of epidermal growth factor receptor (EGFR) p.T790M mutation with progression on erlotinib ● Routinely produces preliminary draft reports with substantial guidance
Level 3 <i>With minimal guidance, interprets the results of molecular testing:</i> <ul style="list-style-type: none"> ○ <i>Identifies assay-specific quality assurance/quality control failures/issues</i> ○ <i>Correlates indication and test results</i> ○ <i>Generates a clinical report</i> 	<ul style="list-style-type: none"> ● Understands how quality assurance/quality control metrics outside expected ranges may impact interpretation of testing; proposes to accept or reject testing with failed quality assurance/quality control, with guidance ● Accepts positive patient results on a run with a failed (e.g., outside two standard deviations) positive control ● Provides guidance to clinicians regarding which test may be more appropriate for a patient's given condition ● Recommends BCR/ABL qualitative testing on a patient newly diagnosed with chronic myelogenous leukemia to confirm presence of the p210 fusion transcript for subsequent BCR/ABL quantitative assay monitoring ● Generates a preliminary report with modest input
Level 4 <i>Independently interprets the results of molecular testing:</i> <ul style="list-style-type: none"> ○ <i>Troubleshoots assays</i> ○ <i>Correlates indication and test results</i> ○ <i>Generates a clinical report</i> 	<ul style="list-style-type: none"> ● Troubleshoots quality assurance/quality control that consistently fails ● Reviews workplace cleaning practices when no-template controls routinely fail ● Confirms that testing results "fit" the clinical picture, and recommends appropriate follow-up testing ● Recommends ABL1 kinase domain testing in the circumstance of rising BCR/ABL fusion transcript ● Generates a preliminary report with little guidance, including those which are highly complex

	<ul style="list-style-type: none"> Integrates multiple longitudinal test reports into a cohesive, succinct report that provides value to the clinicians (e.g., tumor board summary) such as multiple next-generation sequencing reports that track disease progress, rise of resistance mutations
<p>Level 5 Provides guidance and/or participates in setting policies or developing practice guidelines for reporting or interpretation of results including:</p> <ul style="list-style-type: none"> Designing/implementing report template Trains junior learners to interpret results of molecular testing 	<ul style="list-style-type: none"> Participates in identifying testing needs and, development and implementation of novel testing in the laboratory As part of the laboratory team, assists in implementation of MLH1 promotor methylation assay Generates reporting for new testing brought up in the laboratory Assists with training and orienting pathology residents on rotation and guides them on test interpretation and reporting
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> Chart or other system documentation by fellow Discussion regarding quality assurance/quality control during sign-out Portfolio Review of clinician communications (e.g., email) Review of draft reports during sign-out
<p>Curriculum Mapping</p>	<ul style="list-style-type: none">
<p>Notes or Resources</p>	<ul style="list-style-type: none"> CAP. Competency Model for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2021. CAP. Proficiency Testing Resources. https://www.cap.org/laboratory-improvement/proficiency-testing. 2021. Li MM, Datto M, Duncavage EJ, et al. Standards and guidelines for the interpretation and reporting of sequence variants in cancer: A joint consensus recommendation of the Association for Molecular Pathology, American Society of Clinical Oncology, and College of American Pathologists. <i>J Mol Diagn</i>. 2017;19(1):4-23. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5707196/. 2021. Richards S, Aziz N, Bale S, et al. Standards and guidelines for the interpretation of sequence variants: A joint consensus recommendation of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology. <i>Genetics in Medicine</i>. 2015;17:405-423. https://www.nature.com/articles/gim201530. 2021.

Patient Care 3: Interdisciplinary Consultation	
Overall Intent: To develop the skill for interdisciplinary molecular/genomic testing consultations and effectively manage the consultations	
Milestones	Examples
Level 1 <i>Identifies skills (verbal, written), techniques, and knowledge required to provide a consultation</i>	<ul style="list-style-type: none"> • Refers to test directory and testing algorithm to identify the best test for consulted cases • Participates in multidisciplinary meetings/tumor board and email communications in which the learner can acquire the skills and knowledge required for consultation
Level 2 <i>Develops skills and knowledge to manage consultations</i>	<ul style="list-style-type: none"> • Determines appropriateness of molecular/genomic testing and communicates ordering physician regarding any issues • Assists in presenting the results at molecular/genomic tumor board or email communications
Level 3 <i>Manages consultations with assistance</i>	<ul style="list-style-type: none"> • With guidance of attending, communicates test results interpretations and recommendations to a clinical team • Presents molecular/genomic test results at molecular tumor board with guidance by attending
Level 4 <i>Independently manages consultations</i>	<ul style="list-style-type: none"> • Independently communicates test results interpretation and recommendations to a clinical team • Presents molecular/genomic test results at molecular tumor board and lead the discussion
Level 5 <i>Is recognized as an expert in providing comprehensive consultations</i>	<ul style="list-style-type: none"> • Sought out by faculty members/clinical teams for consultative expertise
Assessment Models or Tools	<ul style="list-style-type: none"> • Chart review • Direct observation • Multisource feedback • Portfolio • Presentation
Curriculum Mapping	<ul style="list-style-type: none"> •
Notes or Resources	<ul style="list-style-type: none"> • Consultation can include a variety of interactions: <ul style="list-style-type: none"> ○ Clinician to learner ○ Learner to learner ○ Student to learner ○ Medical technologist to learner ○ Nursing staff members, physician’s assistant, or other health professional to learner ○ On-call, outpatient, and inpatient ○ Formal reports ○ Written or verbal advice and guidance

- Schmidt RL, Panlener J, Hussong JW. An analysis of clinical consultation activities in clinical pathology: Who requests help and why. *Am J Clin Pathol.* 2014;142(3):286-291. <https://academic.oup.com/ajcp/article/142/3/286/1760569>. 2021.

Medical Knowledge 1: Molecular Testing with Various Platforms (Diagnosis, Management, Prognostication) Overall Intent: To demonstrate knowledge of various molecular genetic test methods for diagnosis and guiding management of diseases	
Milestones	Examples
Level 1 <i>Discusses basic principles and applications of various methodologies and testing platforms in the areas of:</i> <ul style="list-style-type: none"> ○ <i>hematopathology</i> ○ <i>heritable diseases</i> ○ <i>identity/human leukocyte antigen (HLA)</i> ○ <i>infectious disease</i> ○ <i>pharmacogenomics</i> ○ <i>solid tumors</i> 	<ul style="list-style-type: none"> ● Discusses next-generation sequencing analysis of single genes, gene panels, and whole exome or genome for somatic and constitutional variant detection ● Discusses quantitative versus qualitative analysis human and microbial genomic variants ● Learns the limitations and applications of techniques for cell free deoxyribonucleic acid (DNA) detection for circulating tumor cells and fetal analysis ● Understands clinical methodologies of quantitative and qualitative assessment such as polymerase chain reaction, isothermal amplification, microarray, expression profiling, and Sanger sequencing ● Explains nucleic acid chemistry and basic DNA mechanisms of replication and repair
Level 2 <i>With substantial guidance, identifies best methods to use for diagnosis and disease-specific management</i>	<ul style="list-style-type: none"> ● Describes the indications for single gene, gene panel and exome analysis ● Knows commonly used approaches for quantitative and qualitative analysis of microbial genomes ● Differentiates appropriate applications of fluorescence in situ hybridization (FISH) and amplification-based detection of genomic variants (i.e., for solid tumors and hematopoietic malignancies)
Level 3 <i>With minimal guidance, identifies best methods for diagnosis and disease-specific management</i>	<ul style="list-style-type: none"> ● Identifies clinical cases where specific genomic profiling (i.e., Kirsten rat sarcoma viral oncogene (KRAS) mutations and anti-EGFR therapies) are appropriate to managing patients with colorectal carcinoma ● Knows which cancer or hereditary disorders gene panel for diagnosis and/or management of disease is appropriate (i.e., FISH versus polymerase chain reaction for minimal residual disease analysis)
Level 4 <i>Independently identifies best methods for diagnosis and disease-specific management</i>	<ul style="list-style-type: none"> ● Selects appropriate cancer or hereditary disorders gene panel for diagnosis and/or management of disease ● Advises other providers regarding appropriate testing for diagnosis and management of disease
Level 5 <i>Develops policies or practice guidelines to apply new techniques or new clinical correlations for testing procedures</i>	<ul style="list-style-type: none"> ● Joins a committee or task force within a professional society (Association for Molecular Pathology, CAP, American College of Medical Genetics (ACMG), others) to develop practice guidelines for use of novel techniques and/or testing approaches ● Leads efforts for continuous quality improvement with respect to evaluating quality metrics of a cancer panel next-generation sequencing test
Assessment Models or Tools	<ul style="list-style-type: none"> ● Direct observation ● Presentations

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	<ul style="list-style-type: none">• Review of quality metrics reports
Curriculum Mapping	<ul style="list-style-type: none">•
Notes or Resources	<ul style="list-style-type: none">• Coleman W, Tsongalis G. <i>Molecular Pathology</i>. 2nd ed. Cambridge, MA: Elsevier Academic Press; 2017. ISBN:9780128027615.

Medical Knowledge 2: Genomic Testing	
Overall Intent: To demonstrate knowledge (indications, workflows and bioinformatic analysis) of and interpret test results for genomic testing	
Milestones	Examples
<p>Level 1 <i>Explains differences between genetic and genomic analysis</i></p> <p><i>Describes basic principles and methodology used for genomic analysis and the roles of bioinformatics and clinical genomic databases in genomic/molecular testing</i></p>	<ul style="list-style-type: none"> • Knows that genetic analysis is: single or few genes, related to inherited/constitutional disorders or disease susceptibilities (e.g., BRCA1 and BRCA2 mutation test for breast cancer) • Knows that genomic analysis is: from several genes to whole genome analysis for a disease (e.g., lung cancer mutation profiling and tumor mutation burden test) • Knows that genomic testing usually needs higher throughput methods (multiplex polymerase chain reaction, next-generation sequencing), and generates large amount of data; bioinformatics is usually required to generate a clinical genomic test report; genomic databases provide valuable information to annotate and interpret genomic test results
<p>Level 2 <i>With substantial guidance, identifies clinical situations in which genomic testing is appropriate</i></p> <p><i>Describes basic workflow of genomic analysis and bioinformatics in genomic/molecular testing and identifies information from clinical databases for final interpretation</i></p>	<ul style="list-style-type: none"> • Learns the indications for genomic testing (mutation profiling and tumor mutation burden testing) for various cancers • Describes basic steps of next-generation sequencing bioinformatics pipeline: base calling, alignment, variant call, variant annotation, and interpretation • Knows the commonly used clinical genomic databases: UCSC [University of California Santa Cruz] Genome Browser, Catalogue of Somatic Mutations in Cancer (COSMIC), The Cancer Genome Atlas program (TCGA), cBioPortal for Cancer Genomics, ClinVar, etc.
<p>Level 3 <i>With minimal guidance, identifies clinical situations in which genomic testing is appropriate</i></p> <p><i>With minimal guidance, interprets the information obtained from genomic testing, applies standard bioinformatics workflow and clinical databases for clinical interpretation, and address errors and artifacts</i></p>	<ul style="list-style-type: none"> • Identifies clinical cases (lung adenocarcinoma versus squamous cell carcinoma versus non-small-cell lung carcinoma diagnosed with only cytology or small biopsy) with or without indications for mutation profiling and tumor mutation burden testing • Performs cancer mutation variant analysis (annotation and interpretation) with minimal guidance • Understands the multiple steps of next-generation sequencing bioinformatics pipeline(s) and how the output is generated; can find the errors and artifacts from the automatic variant calls generated by the pipeline(s) • Navigates through the commonly used clinical genomic databases: UCSC Genome Browser, COSMIC, TCGA, cBioPortal, ClinVar, etc. to help variant interpretation
<p>Level 4 <i>Independently identifies clinical situations in which genomic testing is appropriate</i></p>	<ul style="list-style-type: none"> • Knows why multiple tumor foci from the same patient may need to be tested separately

<p><i>Independently interprets the information obtained from genomic testing, applies standard bioinformatics workflow and clinical databases for clinical interpretation, and troubleshoots genomic testing and bioinformatics pipeline</i></p>	<ul style="list-style-type: none"> • Functions as a junior attending to compile the cancer mutation profiling final report: <ul style="list-style-type: none"> ○ Reviewing tumor type and tumor content ○ Ensuring the quality of the test and the bioinformatics process ○ Independently performing variant analysis ○ Modifying the variant annotation and interpretation by collecting updated information from databases • Identifies challenging situations that frequently create errors (guanine-cytosine-rich regions, homopolymers, multi-nucleotide variants, etc.)
<p>Level 5 <i>Develops national or institutional policies or practice guidelines for genomic testing</i></p> <p><i>Develops and validates genomic tests, bioinformatics pipeline, and/or clinical genomic databases</i></p>	<ul style="list-style-type: none"> • Joins a committee of the professional society (AMP, ACMG, CAP, etc.) contributing to policy making and draft guidelines • Leads the development and validation of a next-generation sequencing based test • Independently develops or makes major contribution to the development of a bioinformatics pipeline for genomic testing
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Review of the fellow's variant interpretation • Review of the fellow's draft report • Presentations
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • American Association for Clinical Chemistry (AACC). Practice Guidelines. https://www.aacc.org/science-and-research/practice-guidelines. 2021. • Association for Molecular Pathology (AMP). Emerging and Evolving Biomarkers: Recent Findings, Laboratory Considerations, and Clinical Implications. https://www.amp.org/education/emerging-and-evolving-biomarkers/. 2021. • National Human Genome Research Institute (NIH). Genetics vs. Genomics Fact Sheet. https://www.genome.gov/about-genomics/fact-sheets/Genetics-vs-Genomics. 2021. • NCCN guidelines, other professional society (AMP, ACMG, CAP, etc.) guidelines.

Medical Knowledge 3: Patient-Centered Interpretation	
Overall Intent: To demonstrate the interpretation of results through the incorporation of ancillary data	
Milestones	Examples
Level 1 <i>Understands the importance of ancillary data (e.g., medical history, family history, other diagnostic results) in the interpretation of molecular results</i>	<ul style="list-style-type: none"> • Articulates the importance of reviewing patient history and other diagnostic results in the interpretation of molecular results
Level 2 <i>With substantial guidance, seeks and incorporates ancillary data (e.g., medical history, family history, other diagnostic results) in the interpretation of molecular results</i>	<ul style="list-style-type: none"> • With significant direction, obtains and/or identifies information about the patient’s medical history, the patient’s family history, or other ancillary test results and uses this information, with assistance, to aid in interpretation of molecular results: <ul style="list-style-type: none"> ○ When prompted, obtains the patient’s bone marrow transplant history to aid in interpretation of bone marrow engraftment studies ○ Upon request, incorporates identifies the appropriate anatomic pathology report in which to incorporate molecular pathology results
Level 3 <i>With minimal guidance, seeks and incorporates ancillary data (e.g., medical history, family history, other diagnostic results) in the interpretation of molecular results</i>	<ul style="list-style-type: none"> • With some direction, obtains and/or identifies information about the patient’s medical history, the patient’s family history, or other ancillary test results and uses this information, with minimal assistance, to aid in interpretation of molecular results: <ul style="list-style-type: none"> ○ Comes prepared to sign out with genetic counseling notes and family pedigree for review and discussion when signing out next generation sequencing results for American College of Obstetricians and Gynecologists/ACMG recommended carrier screening ○ Upon discussion, correlates molecular and anatomic/morphologic findings to recommend specific targeted therapeutic options
Level 4 <i>Independently seeks and incorporates ancillary data (e.g., medical history, family history, other diagnostic results) in the interpretation of molecular results</i>	<ul style="list-style-type: none"> • Consistently and independently, obtains and/or identifies information about the patient’s medical history, the patient’s family history, or other ancillary test results and uses this information to aid in interpretation of molecular results: <ul style="list-style-type: none"> ○ Regularly obtains the morphologic diagnosis, flow cytometry findings, and cytogenetic results when reviewing molecular diagnostic testing for hematologic malignancies and correlates all findings to provide a comprehensive diagnostic and prognostic report ○ Independently identifies and troubleshoots conflicting results (e.g., promyelocytic leukemia/retinoic acid receptor alpha-negative FISH with positive qualitative promyelocytic leukemia/retinoic acid receptor alpha reverse transcription polymerase chain reaction results)
Level 5 <i>Develops algorithms and/or practice guidelines to incorporate ancillary data (e.g.,</i>	<ul style="list-style-type: none"> • Contributes to the development of algorithms and/or practice guidelines on the local regional or national level that incorporate necessary clinical and laboratory information in the interpretation of molecular diagnostic results

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<i>medical history, family history, other diagnostic results) in the interpretation of molecular results</i>	<ul style="list-style-type: none"> • Reviews regional disease prevalence data to recommend prioritization for specific genetic mutations in population screening for the hospital laboratory
Assessment Models or Tools	<ul style="list-style-type: none"> • Direct observation • Portfolio • Report review
Curriculum Mapping	<ul style="list-style-type: none"> •
Notes or Resources	<ul style="list-style-type: none"> • CAP. Competency Models for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2021.

Medical Knowledge 4: Assay Design and Verification/Validation	
Overall Intent: To verify and validate new assays as medical director of a laboratory, understanding all components that are a part of comprehensive and systemic verification or validation process, and to apply the most current best practices	
Milestones	Examples
<p>Level 1 <i>Recognizes the requirements for validation and verification (FDA-approved) of molecular tests</i></p> <p><i>Recognizes the components of a validation or verification summary</i></p>	<ul style="list-style-type: none"> • Identifies the assay types that require clinical validation versus verification in the clinical laboratory setting • Identifies required elements of molecular diagnostic assay clinical and analytical validation or verification based on assay type, including assessment of accuracy, precision, reportable range, linear range, reference intervals, analytic sensitivity, and analytic specificity • Describes the various elements of assay design, and reviews a prior assay validation plan and summary
<p>Level 2 <i>With substantial guidance, designs assay, validation or verification experiments, and/or interpretation of the validation or verification data</i></p> <p><i>Discusses and understand calculations for the components of a validation or verification summary</i></p>	<ul style="list-style-type: none"> • Participates in assay design or new test selection, reviews the literature for evidence of the clinical use and/or clinical validity of a specific test • Performs a detailed review of a prior assay validation or verification • Participates in performing or data interpretation of assay validation or verification experiments • Participates in drafting an assay validation or verification plan or summary
<p>Level 3 <i>With minimal guidance, designs assay, validation or verification experiments, and interpretation of the validation or verification data</i></p> <p><i>Drafts written validation or verification summary with guidance</i></p>	<ul style="list-style-type: none"> • Participates in assay design or new test selection, designs assay validation or verification experiments with guidance, and drafts an assay validation plan or summary with guidance • Performs assay validation or verification experiments or interprets data, participates in assay optimization and troubleshooting • Participates in drafting a standard operating procedure for an assay or in a test build for reporting of assay results
<p>Level 4 <i>Independently designs assay, validation or verification experiments, and interpretation of the validation or verification data</i></p> <p><i>Independently provides a written validation or verification summary</i></p>	<ul style="list-style-type: none"> • Independently designs validation experiments, leads laboratory team through validation experiments, and data analysis • Independently writes a comprehensive validation plan and final validation report
<p>Level 5 <i>Leads/participates in expert guidelines for test validation</i></p>	<ul style="list-style-type: none"> • Participates in national or international committee to draft test validation guideline or statement manuscripts

<p><i>Is recognized as a content expert in validation design and data interpretation</i></p>	<ul style="list-style-type: none"> • Is invited to speak on molecular test validation at a national or international forum
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Portfolio • Presentation • Review of draft assay validation or verification documents (plan, summary, standard operating procedures)
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • AMP. Validation Resources. https://www.amp.org/resources/validation-resources/. 2021. • CAP. Accreditation Checklists. https://www.cap.org/laboratory-improvement/accreditation/accreditation-checklists. 2021. • CLSI. <i>MM17: Validation and Verification of Multiplex Nucleic Acid Assays</i>. 2nd ed. Wayne, PA: Clinical and Laboratory Standards Institute; 2018. ISBN:978-1-68440-005-8. • U.S. Food and Drug Administration. In-Vitro Diagnostics. https://www.fda.gov/medical-devices/products-and-medical-procedures/vitro-diagnostics. 2021. <ul style="list-style-type: none"> ○ Nucleic acid-based tests ○ Companion diagnostics

Systems-Based Practice 1: Patient Safety and Quality Improvement (QI)	
Overall Intent: To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals; to conduct a QI project	
Milestones	Examples
<p>Level 1 <i>Demonstrates knowledge of common patient safety events</i></p> <p><i>Demonstrates knowledge of how to report patient safety events</i></p> <p><i>Demonstrates knowledge of basic QI methodologies and metrics</i></p>	<ul style="list-style-type: none"> • Has basic knowledge of patient safety events, reporting pathways, and QI strategies, but has not yet participated in such activities
<p>Level 2 <i>Identifies system factors that lead to patient safety events</i></p> <p><i>Reports patient safety events through institutional reporting systems (simulated or actual)</i></p> <p><i>Describes departmental and institutional QI initiatives</i></p>	<ul style="list-style-type: none"> • Identifies and reports a patient safety issue (real or simulated), along with system factors contributing to that issue • Is aware of improvement initiatives within their scope of practice
<p>Level 3 <i>Participates in analysis of patient safety events (simulated or actual)</i></p> <p><i>Participates in disclosure of patient safety events to clinicians and/or patients and their families, as appropriate (simulated or actual)</i></p> <p><i>Participates in departmental and institutional QI initiatives</i></p>	<ul style="list-style-type: none"> • Reviews a patient safety event (e.g., joining a root cause analysis group, participating in an SBAR (Situation-Background-Assessment-Recommendation) analysis) and has communicated with clinical teams about such an event • Participates in a QI project, though they may not have yet designed a QI project
<p>Level 4 <i>Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)</i></p>	<ul style="list-style-type: none"> • Collaborates with a team to lead the analysis of a patient safety event and can competently communicate with the clinical team (e.g., physicians, mid-level providers) patients/families about those events

<p><i>Discloses patient safety events to clinicians and/or patients and their families, as appropriate (simulated or actual)</i></p> <p><i>Demonstrates the skills required to identify, develop, implement, and analyze a QI project</i></p>	<ul style="list-style-type: none"> • Initiates and completes a QI project, including communication with stakeholders
<p>Level 5 <i>Actively engages teams and processes to modify systems to prevent patient safety events</i></p> <p><i>Role models or mentors others in the disclosure of patient safety events</i></p> <p><i>Creates, implements, and assesses QI initiatives at the institutional or community level</i></p>	<ul style="list-style-type: none"> • Competently assumes a leadership role at the departmental or institutional level for patient safety and/or QI initiatives, possibly even being the person to initiate action or call attention to the need for action
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Chart or other system documentation by fellow • Direct observation in meetings • Documentation of QI or patient safety project processes or outcomes • E-module multiple choice tests • Portfolio • Reflection • Simulation • 360-degree evaluations
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Institute of Healthcare Improvement. http://www.ihl.org/Pages/default.aspx. 2021.

Systems-Based Practice 2: Systems Navigation for Patient-Centered Care	
Overall Intent: To effectively navigate the health care system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes	
Milestones	Examples
<p>Level 1 <i>Demonstrates knowledge and importance of coordination in patient care</i></p> <p><i>Explains key elements for safe and effective transitions of care and hand-offs</i></p>	<ul style="list-style-type: none"> • Identifies the members of the interprofessional team, including histotechnologists, laboratory technicians, consultants, other specialty physicians, nurses, and consultants, and describes their roles but is not yet routinely using team members or accessing all available resources • Lists the essential components of an effective sign-out and care transition including sharing information necessary for successful on-call/off-call transitions of urgent cases or confirmatory testing
<p>Level 2 <i>Coordinates care of patients in routine cases effectively among clinical and laboratory teams</i></p> <p><i>Performs safe and effective transitions of care/hand-offs in routine situations</i></p>	<ul style="list-style-type: none"> • Contacts interprofessional team members for routine cases, but requires supervision to ensure all necessary testing, and resource needs are arranged for limited tissue available for testing • Performs a routine case sign-out but still needs direct supervision to identify and appropriately triage cases or calls (priority versus non-priority case or call) and anticipatory guidance
<p>Level 3 <i>Coordinates care of patients in complex cases effectively among clinical and laboratory teams</i></p> <p><i>Performs safe and effective transitions of care/hand-offs in complex situations</i></p>	<ul style="list-style-type: none"> • At interdisciplinary tumor boards (e.g., solid organ or hematopoietic malignancies), engages in appropriate discussion of patient care testing options and impact on therapy for complex pathologic cases
<p>Level 4 <i>Models effective coordination of patient-centered care among different disciplines and specialties</i></p> <p><i>Models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems</i></p>	<ul style="list-style-type: none"> • Role models and educates students and more junior team members regarding the engagement of appropriate interprofessional team members, as needed for each patient and/or case, and ensures the necessary resources have been arranged • Proactively notifies clinical team of actionable molecular test results (e.g., returning result of clonality testing to ordering pathologist) • Performs quality reviews and correlations between large panel results and rapid single analyte assays
<p>Level 5 <i>Analyzes the process of care coordination and leads in the design and implementation of improvements</i></p>	<ul style="list-style-type: none"> • Works with hospital or laboratory site team members or leadership to analyze care coordination and laboratory services in that setting, and takes a leadership role in

<p><i>Designs improvement in quality of transitions of care within and across health care delivery systems to optimize patient outcomes</i></p>	<p>designing and implementing changes to improve the care coordination and laboratory workflow/menu process and design</p> <ul style="list-style-type: none"> • Works with a QI mentor to identify better hand-off tools for complex and multimodality cases
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Case management quality metrics and goals mined from electronic health records (EHR), laboratory informatics systems • Direct observation (including discussion during case work-up and case presentations) • Lectures/workshops on social determinants of health or population health with identification of local resources • Pathology report review • Portfolio • Review of sign-out tools, use and review of checklists • 360-degree feedback from the interprofessional team
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Aller RD. Pathology's contributions to disease surveillance: Sending our data to public health officials and encouraging our clinical colleagues to do so. <i>Archives of Path Lab Med.</i> June 2009;133(6)926-932. https://pubmed.ncbi.nlm.nih.gov/19492885/. 2021. • CAP. Competency Model for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2021. • Kaplan KJ. In pursuit of patient-centered care. https://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. 2021.

Systems-Based Practice 3: Community Health	
Overall Intent: To effectively navigate the health care system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes	
Milestones	Examples
Level 1 <i>Demonstrates knowledge of population and community health needs and disparities</i>	<ul style="list-style-type: none"> Identifies components of social determinants of health and how they impact the delivery of patient care
Level 2 <i>Identifies pathology's role in population and community health needs and inequities for the local population</i>	<ul style="list-style-type: none"> Identifies different populations within own panel of patients, cases, and/or the local community Knows which patients are at high risk for specific health outcomes related to health literacy concerns, cost of testing or therapy, LGBTQ status, etc. Identifies group-specific risk factors for infectious disease exposures
Level 3 <i>Identifies opportunities for pathologists to participate in community and population health</i>	<ul style="list-style-type: none"> Appreciates the need for and uses clinic or local resources, (e.g., such as when coordinating pathology case handling from an outside clinic to the hospital setting for a patient with lung cancer who is being transferred to hospital; coordinates specimen handling and ordering of standard materials for molecular testing)
Level 4 <i>Recommends and/or participates in changing and adapting practice to provide for the needs of communities and populations</i>	<ul style="list-style-type: none"> Performs quality reviews and correlations of mutation incidence in local laboratory population and other outside populations Identifies patient populations at high risk for poor health care outcomes related to infectious or inherited disease due to health disparities and inequities in screening and implements strategies to improve care
Level 5 <i>Leads innovations and advocates for populations and communities with health care inequities</i>	<ul style="list-style-type: none"> Designs a social determinants of health curriculum to help others learn to identify local resources and barriers to care and laboratory testing; especially as relates to inherited and infectious disease
Assessment Models or Tools	<ul style="list-style-type: none"> Case management quality metrics and goals mined from EHR, laboratory informatics systems Direct observation (including discussion during case work-up and case presentations) Lectures/workshops on social determinants of health or population health with identification of local resources Pathology report review Portfolio Review of sign-out tools, use and review of checklists between pathology services 360-degree feedback from the interprofessional team
Curriculum Mapping	<ul style="list-style-type: none">
Notes or Resources	<ul style="list-style-type: none"> Aller RD. Pathology's contributions to disease surveillance: Sending our data to public health officials and encouraging our clinical colleagues to do so. <i>Archives of Path Lab Med.</i> June 2009;133(6)926-932. https://pubmed.ncbi.nlm.nih.gov/19492885/. 2021.

- CAP. Competency Model for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2021.
- CDC. Population Health Training. <https://www.cdc.gov/pophealthtraining/whatis.html>. 2021.
- Kaplan KJ. In pursuit of patient-centered care. <https://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns>. 2021.

Systems-Based Practice 4: Physician Role in Health Care System	
Overall Intent: To understand the physician’s role in the complex health care system and how to optimize the system to improve patient care and the health system’s performance	
Milestones	Examples
<p>Level 1 <i>Identifies key components of the complex health care system (e.g., hospital, skilled nursing facility, finance, personnel, technology)</i></p> <p><i>Describes basic health payment systems (e.g., government, private, public, uninsured care) and practice models</i></p>	<ul style="list-style-type: none"> • Recognizes the multiple, often competing forces, in the health care system (e.g., names systems and providers involved test ordering and payment) • Recognizes there are different payment systems, such as Medicare, Medicaid, Veterans Affairs (VA), and commercial third-party payors, and contrast practice models, such as a patient-centered medical home and an accountable care organization; compares and contrasts types of health benefit plans, including preferred provider organization and health maintenance organization • With direct supervision, completes a report following a routine patient specimen and apply appropriate coding in compliance with regulations
<p>Level 2 <i>Describes how components of a complex health care system are interrelated, and how this impacts patient care</i></p> <p><i>Documents testing detail and explains the impact of documentation on billing and reimbursement</i></p>	<ul style="list-style-type: none"> • Understands the impact of health plans on testing workflow and reimbursement; demonstrates knowledge that is theoretical, but is not yet able to apply this knowledge to the care of patients without some direct attending input and/or prompting • Begins to think through clinical redesign to improve quality; begins to modify personal practice to enhance outcomes • Completes a report following a routine patient specimen and applies appropriate coding in compliance with regulations, with oversight
<p>Level 3 <i>Discusses how individual practice affects the broader system (e.g., test utilization, turnaround time)</i></p> <p><i>Engages with clinicians and/or patients in shared decision making, such as use of preauthorization for complex testing</i></p>	<ul style="list-style-type: none"> • Understands, accesses, and analyzes own individual performance data; relevant data may include: <ul style="list-style-type: none"> ○ Portfolio ○ Case log (if used at institution) • Consistently thinks through clinical redesign to improve quality and modifies personal practice to enhance outcomes • Uses shared decision and adapts the choice of the most cost-effective testing depending on the relevant clinical needs

<p>Level 4 <i>Manages various components of the complex health care system to provide efficient and effective patient care and transition of care</i></p> <p><i>Practices and advocates for cost-effective patient care with consideration of the limitations of each patient's payment model</i></p>	<ul style="list-style-type: none"> • Works collaboratively with the institution to improve patient resources or design the institution's testing needs assessment, or develop/implement/assess the resulting action plans • Uses most appropriate testing platform to provide necessary clinical information given constraints of insurance coverage
<p>Level 5 <i>Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transition of care</i></p> <p><i>Participates in health policy advocacy activities</i></p>	<ul style="list-style-type: none"> • Performs a Lean analysis of laboratory practices to identify and modify areas of improvement to make laboratory testing more efficient • Participates in professional society committee to draft guidelines
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Audit of testing usage • Direct observation • Portfolio • QI project (perhaps as part of a portfolio): The resident's QI project may serve as an excellent assessment model/tool to assess this subcompetency. The program can develop criteria to ensure the resident is able to access and analyze personal practice data, and work with others to design and implement action plans, and subsequently evaluate the outcome and the impact of the plan(s).
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Agency for Healthcare Research and Quality (AHRQ). Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/index.html. 2021. • AHRQ. Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2021. • American Board of Internal Medicine. QI/PI activities. https://www.abim.org/maintenance-of-certification/earning-points/qi-pi-activities.aspx. 2021. • The Commonwealth Fund. Health System Data Center. https://datacenter.commonwealthfund.org/#ind=1/sc=1. 2021. • Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities form a national academy of medicine initiative. <i>JAMA</i>. 2017;317(14):1461-1470. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. 2021. • The Kaiser Family Foundation. Topic: Health Reform: https://www.kff.org/topic/health-reform/. 2021.

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Systems-Based Practice 5: Accreditation, Compliance, and Quality	
Overall Intent: To gain in-depth knowledge of the components of laboratory accreditation, regulatory compliance, and quality management	
Milestones	Examples
<p>Level 1 <i>Demonstrates knowledge that laboratories must be accredited and knowledge of the roles of different agencies</i></p> <p><i>Discusses the need for quality control and proficiency testing</i></p>	<ul style="list-style-type: none"> • Attends departmental/laboratory quality assurance/quality control meetings, morbidity and mortality (M and M) conferences and accreditation/regulatory summation meetings • Is familiar with all proficiency challenges performed by the laboratory
<p>Level 2 <i>Demonstrates knowledge of the components of laboratory accreditation and regulatory compliance (Clinical Laboratory Improvement Amendments and others), either through training or experience</i></p> <p><i>With assistance, interprets quality data, charts, and trends, including proficiency testing results</i></p>	<ul style="list-style-type: none"> • Explains lab accreditation and regulatory requirements for the laboratory • Reviews daily instrument and assay quality control and monitors trends of indicators or controls over time, e.g., Levy Jennings curves • Reviews proficiency survey results and returned reports
<p>Level 3 <i>Identifies the differences between accreditation and regulatory compliance; discusses the processes for achieving accreditation and maintaining regulatory compliance</i></p> <p><i>Demonstrates knowledge of the components of a laboratory quality management plan, including submission and review of proficiency testing results and understanding the implications of testing failures</i></p>	<ul style="list-style-type: none"> • Completes inspector training for accreditation agency (e.g., CAP) to understand process for achieving/maintaining regulatory/accreditation compliance • Interprets results of proficiency challenges prior to submission and reviews results from returned surveys • Participates in regularly scheduled laboratory quality management meetings and participates in review and discussion of instrument quality control, review of allele frequencies for germline and somatic testing and positivity rates for pathogens, turnaround times, number of failed assays and DNA extraction, failed assay quality control, rejected samples, staffing issues, or equipment and resource needs
<p>Level 4 <i>Participates in an internal laboratory inspection (actual or simulated)</i></p> <p><i>Participates in laboratory quality team:</i></p> <ul style="list-style-type: none"> ○ <i>Drafts response to inspection deficiencies (actual or simulated)</i> 	<ul style="list-style-type: none"> • Performs mock or self-inspection using a CAP checklist • Reviews prior inspection deficiencies and failed proficiency testing • Assists in development of proposals for staffing, equipment, or other resource needs • Assists in developing a strategy for handling quality control or proficiency testing failures and drafts a response

<p>Level 5 <i>Participates in an external laboratory inspection</i></p> <p><i>Participates in laboratory quality team:</i></p> <ul style="list-style-type: none"> ○ <i>Independently crafts response to inspection deficiencies or proficiency failures</i> ○ <i>Reviews the quality management plan to identify areas for improvement</i> 	<ul style="list-style-type: none"> • Participates in an external laboratory inspection • Independently drafts response to inspection deficiencies or proficiency failures • Serves on an institutional, regional, or national quality management committee
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Assignment of duties for departmental or hospital quality assurance/quality control committees • Documentation of inspector training and participation in resident portfolio • Planning and completion of QI projects • Presentation at M and M conferences • Rotation evaluations/ Personal observation
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • CAP. Inspector Tools and Training. https://www.cap.org/laboratory-improvement/accreditation/inspector-tools-and-training. 2021.

Systems-Based Practice 6: Utilization	
Overall Intent: To promote efficient use of laboratory resources to improve patient outcomes via behavioral changes within the laboratory and the health care system	
Milestones	Examples
<p>Level 1 <i>Identifies general molecular pathology work practices and workflow (e.g., nucleic acid extraction, polymerase chain reaction (PCR)-based testing)</i></p> <p><i>Recognizes outside resources for referred testing</i></p>	<ul style="list-style-type: none"> • Understands pros and cons of different molecular/genomic testing methodology and ability to select best testing strategy • Recognizes that urgent clinical need and turnaround, test volume, cost, and complexity should contribute to the composition of the clinical test catalog • Recognizes that tests can be ordered via electronic, paper requisition, verbal, add-on, approval only, and reflex methods • Recognizes that referred tests have a higher incremental cost than tests performed in-house
<p>Level 2 <i>Explains rationale for optimizing utilization, including batching and reflex algorithms</i></p> <p><i>Evaluates the need for referred testing</i></p>	<ul style="list-style-type: none"> • With supervision, reviews appropriateness of genetic referral testing (whole exome sequencing or targeted next-generation sequencing panel testing) order for the patient, particularly inpatients • Evaluates appropriateness of the molecular test orders placed by treating physician and avoid duplicated testing • With supervision, plays a consultant role as to selection of molecular testing (choosing wisely)
<p>Level 3 <i>Identifies opportunities to optimize utilization of resources by reviewing reflex testing algorithms</i></p> <p><i>Participates in review of referral lab certification and appropriateness for referred testing</i></p>	<ul style="list-style-type: none"> • Reviews appropriateness of genetic referral testing requests and discuss economic impact of the testing on hospital with ordering physician. • Participates in test utilization committee where appropriateness of referral testing (e.g., ribonucleic acid (RNA) expression-based propriety testing such as DetemaRX© (oncotype for non-small-cell lung carcinoma)) is discussed • Independently advises clinical teams of appropriate testing approaches and algorithms
<p>Level 4 <i>Participates in a utilization review</i></p> <p><i>Helps to establish appropriate criteria for referred testing (i.e., correct gene/disorder)</i></p>	<ul style="list-style-type: none"> • Evaluates the appropriateness of the test requested by clinical team as a part of test utilization committee • Participates in setting institutional guidelines for referral testing

<p>Level 5 <i>Completes a utilization review and drafts change plan</i></p> <p><i>Optimizes a test menu based on trends of referred testing</i></p>	<ul style="list-style-type: none"> • Develops tools to prevent repeat germline testing • Plays a leading role in test utilization committee or guideline committee • Participates in national level of utilization committee
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Multisource evaluation • Presentations • Rotation evaluations • Test utilization audit
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Baird G. The laboratory test utilization management toolbox. <i>Biochem Med.</i> 2014;24(2):223-234. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4083574/. 2021. • Choosing Wisely. American Society for Clinical Pathology. https://www.choosingwisely.org/societies/american-society-for-clinical-pathology/. 2021. • Rubinstein M, Hirsch R, Bandyopadhyay K. Effectiveness of practices to support appropriate laboratory test utilization. <i>AJCP.</i> 2018;149(3):197-221. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6016712/. 2021.

Practice-Based Learning and Improvement 1: Evidence-Based Practice	
Overall Intent: To incorporate evidence into clinical practice	
Milestones	Examples
Level 1 <i>Demonstrates how to access and select applicable evidence and use appropriate resources</i>	<ul style="list-style-type: none"> Recognizes that molecular testing is useful in the work-up for diagnostic entities for which molecular findings are needed for appropriate classification (e.g., gliomas, select solid tumors, and hematologic malignancies)
Level 2 <i>Identifies and applies the best available evidence to guide diagnostic work-up of simple cases</i>	<ul style="list-style-type: none"> Orders/recommends molecular testing for pathologic entities (e.g., 1p/19q co-deletion by FISH for oligodendroglioma or BCR-ABL1 FISH for chronic myelogenous leukemia)
Level 3 <i>Identifies and applies the best available evidence to guide diagnostic work-up of complex cases</i>	<ul style="list-style-type: none"> Orders/recommends additional molecular testing to further classify diagnostic entities (e.g., isocitrate dehydrogenase/ATRX testing for gliomas, ABL1 kinase domain mutation testing for relapsed chronic myelogenous leukemia)
Level 4 <i>Critically appraises and applies evidence to guide care, even in the face of conflicting data</i>	<ul style="list-style-type: none"> Appropriately researches the primary literature to explain rare molecular findings that surface from additional molecular testing (e.g., establishes level of evidence for unexpected next-generation sequencing findings, identifies literature to support variant classification in diverse tumor types)
Level 5 <i>Teaches others to critically appraise and apply evidence for complex cases; and/or leads/participates in the development of guidelines</i>	<ul style="list-style-type: none"> Moderates a discussion with clinicians over disparate molecular, morphologic, and immunohistochemical findings of a tumor to formulate the best course forward based on the primary literature
Assessment Models or Tools	<ul style="list-style-type: none"> Direct observation Oral or written examination Presentation Review of clinical reports
Curriculum Mapping	<ul style="list-style-type: none">
Notes or Resources	<ul style="list-style-type: none"> Institutional IRB guidelines National Institutes of Health. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2021. U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2021. Various journal submission guidelines

Practice-Based Learning and Improvement 2: Scholarly Activity	
Overall Intent: Involved in contributing to the body of knowledge in pathology while adhering to regulatory principles pertinent to genetic analyses	
Milestones	Examples
Level 1 <i>Is aware of the need for patient privacy, autonomy, consent, and information safeguarding as applied to clinical and genetic research</i>	<ul style="list-style-type: none"> • Reviews Health Insurance Portability and Accountability Act (HIPAA) regulations relevant to clinical and genetic research • Recognizes different scenarios where patient consent is required/waived • Identifies institutional policies that regulate data storage, retrieval, and authorized access • Identifies the need for Institutional Review Board (IRB) when conducting research • Understands how genetic testing is used for clinical, translational, and investigational research
Level 2 <i>Develops knowledge of the basic principles of research particularly as it pertains to genetic testing (demographics, Institutional Review Board, human subjects), including how research is evaluated, conducted, and applied to patient care</i>	<ul style="list-style-type: none"> • Completes an IRB course for human research • Understands the process of peer-review • Recognizes and discerns the clinical, translational, and investigational research initiatives in the education and training setting • Reads and discusses a peer-review critique of submitted manuscript
Level 3 <i>Applies knowledge of the basic principles of research, such as informed consent, and research protocols to clinical practice particularly as it pertains to genetic testing, with assistance</i>	<ul style="list-style-type: none"> • Contributes to research project or data management initiative • Drafts a research consent document with guidance • Drafts an IRB protocol with guidance • Writes or presents scholarly activity with guidance (e.g., assists with abstract or manuscript submission, poster/platform presentation, or presentation at institution-specific engagement) • Critically reviews others' scholarly activity with guidance (e.g., assists with peer-review of manuscript, project proposals, or institutional initiatives)
Level 4 <i>Proactively and consistently applies knowledge of the basic principles of research, such as informed consent and research protocols to clinical practice particularly as it pertains to genetic testing</i>	<ul style="list-style-type: none"> • Leads a research project or data management initiatives • Drafts a research consent document independently • Drafts an IRB protocol independently • Writes or presents scholarly activity (e.g., first/last author on published manuscript, discusses poster at national meeting, platform presentation) • Critically reviews others' scholarly activity independently (independent peer-review of manuscript, project proposals, or institutional initiatives)
Level 5 <i>Suggest improvements to research regulations and/or substantially contributes to the primary literature through basic, translational, or clinical research</i>	<ul style="list-style-type: none"> • Is recognized as a content expert in chosen field of study • Serve as a member of a journal editorial board • Serves as an invited speaker for content within field of study • Serves on IRB or equivalent committee

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Assessment Models or Tools	<ul style="list-style-type: none">• Direct observation• Periodic review of data and/or experimental design• Presentation• Review of written or presented work
Curriculum Mapping	<ul style="list-style-type: none">•
Notes or Resources	<ul style="list-style-type: none">• CITI Program. https://about.citiprogram.org/en/homepage/. 2021.• Institutional IRB guidelines• National Institutes of Health. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2021.• U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2021.• Various journal submission guidelines

Practice-Based Learning and Improvement 3: Reflective Practice and Commitment to Personal Growth	
Overall Intent: To seek clinical performance information with the intent to improve care; reflects on all domains of practice, personal interactions, and behaviors, and their impact on technologists, colleagues and patients (if applicable) (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	Examples
<p>Level 1 <i>Accepts responsibility for personal and professional development by establishing goals</i></p> <p><i>Identifies the gap(s) between expectations and actual performance</i></p> <p><i>Actively seeks help in designing a learning plan</i></p>	<ul style="list-style-type: none"> • Is aware of need to improve • Begins to seek ways to determine where improvements are needed and makes some specific goals that are reasonable to execute and achieve
<p>Level 2 <i>Demonstrates openness to receiving performance data and feedback to inform goals</i></p> <p><i>Analyzes and reflects on the factors that contribute to gap(s) between expectations and actual performance</i></p> <p><i>With assistance, designs and implements a learning plan</i></p>	<ul style="list-style-type: none"> • Increasingly identifies performance gaps in terms of diagnostic skills and daily work; uses feedback from others • After working with an attending for a week, asks the attending about personal performance and opportunities for improvement • Uses feedback with a goal of improving communication skills with technologists, peers/colleagues, staff members, and patients (if applicable) the following week
<p>Level 3 <i>Seeks performance data and feedback with a receptive mindset</i></p> <p><i>Institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance</i></p> <p><i>Independently creates and implements a learning plan</i></p>	<ul style="list-style-type: none"> • Takes input from technologists, peers/colleagues, and supervisors to gain complex insight into personal strengths and areas to improve • Humbly acts on input and is appreciative and not defensive • Documents goals in a more specific and achievable manner, such that attaining them is reasonable and measurable
<p>Level 4 <i>Actively and consistently seeks performance data and feedback with a receptive mindset</i></p> <p><i>Critically evaluates and continues to optimize the behavioral changes in narrowing the gap(s) between expectations and actual performance</i></p>	<ul style="list-style-type: none"> • Is clearly in the habit of making a learning plan for each rotation • Consistently identifies ongoing gaps and chooses areas for further development

<p><i>Uses performance data to measure the effectiveness of the learning plan and improves it when necessary</i></p>	
<p>Level 5 Models seeking performance data with a receptive mindset</p> <p><i>Teaches others reflective practice</i></p> <p><i>Facilitates the design and implementation of learning plans for others</i></p>	<ul style="list-style-type: none"> • Actively discusses learning goals with supervisors and colleagues; may encourage other learners on the team to consider how their behavior affects the rest of the team
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Review of learning plan
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. <i>Academic Pediatrics</i>. 2014;14(2 Suppl):S38-S54. https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/pdf. 2021. • Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. <i>Academic Medicine</i>. 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians_Lifelong.21.aspx. 2021. • Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. <i>Academic Medicine</i>. 2013;88(10):1558-1563. https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents_Written_Learning_Goals_and.39.aspx. 2021.

Professionalism 1: Professional Behavior and Ethical Principles	
Overall Intent: To recognize and address lapses in ethical and professional behavior, demonstrates ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas	
Milestones	Examples
<p>Level 1 <i>Demonstrates knowledge of the ethical principles underlying laboratory testing, including informed consent, confidentiality, error disclosure, stewardship of limited resources, equitable treatment of patient samples, and review of appropriateness of laboratory testing</i></p> <p><i>Describes when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses</i></p>	<ul style="list-style-type: none"> • Identifies and describes potential triggers for professionalism lapses, describes when and how to appropriately report professionalism lapses, and outlines strategies for addressing common barriers to reporting • Discusses the basic principles underlying ethics (beneficence, nonmaleficence, justice, autonomy) and professionalism (professional values and commitments), and how they apply in various situations (e.g., informed consent process) • Understands the specific rationale for policies and procedures implemented to ensure compliance related to the ethical issues • Demonstrates sensitivity to roles and responsibilities of all members in a team-based setting • Treats all team members respectfully and professionally irrespective of the title, rank, and role
<p>Level 2 <i>Analyzes straightforward situations using ethical principles</i></p> <p><i>Demonstrates insight into professional behavior in routine situations; takes responsibility for understanding own personal role in professionalism lapses</i></p>	<ul style="list-style-type: none"> • Demonstrates professional behavior in routine situations and uses ethical principles to analyze straightforward situations, and can acknowledge a lapse without becoming defensive, making excuses, or blaming others • Apologizes for the lapse when appropriate and taking steps to make amends if needed • Articulates strategies for preventing similar lapses in the future Monitors and responds to fatigue, hunger, stress, etc. in self and team members • Recognizes and responds effectively to the emotions of others
<p>Level 3 <i>Recognizes the need for and uses appropriate resources to seek guidance in managing and resolving complex ethical situations</i></p>	<ul style="list-style-type: none"> • Analyzes complex situations, such as how the clinical situation evokes strong emotions, conflicts (or perceived conflicts) between patients/providers/staff or between professional values; the resident navigates a situation while not at his/her personal best (due to fatigue, hunger, stress, etc.), or the system poses barriers to professional behavior (e.g., inefficient workflow, inadequate staffing, conflicting policies) • Recognizes own limitations and seeks resources to help manage and resolve complex ethical situations such as: <ul style="list-style-type: none"> ○ consulting with a genetic counselor about the implications of genetic testing ○ requesting an ethics consult for an unexpected result ○ submitting IRB review for a research project

<p><i>Demonstrates professional behavior in complex or stressful situations</i></p>	<ul style="list-style-type: none"> Analyzes difficult real or hypothetical ethics and professionalism case scenarios or situations, recognizes own limitations, and consistently demonstrates professional behavior
<p>Level 4 <i>Independently resolves and manages complex ethical situations</i></p> <p><i>Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in self and in others</i></p>	<ul style="list-style-type: none"> Actively seeks to consider the perspectives of others Models respect for patients and team members and expects the same from others Recognizes and uses appropriate resources for managing and resolving ethical dilemmas (e.g., ethics consultations, literature review, risk management/legal consultation) Serves as the trainee member of a professional committee appropriate for the level of training e.g., the IRB or Ethics Committee, fellow committee
<p>Level 5 <i>Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution</i></p> <p><i>Coaches others when their behavior fails to meet professional expectations</i></p>	<ul style="list-style-type: none"> Identifies and seeks to address system-wide factors or barriers to promoting a culture of ethical and professional behavior through participation in a work group, committee, or task force (e.g., ethics committee or an ethics subcommittee, risk management committee, root cause analysis review, patient safety or satisfaction committee, professionalism work group, IRB, resident/fellow grievance committee, etc.) Coaches others when behavior fails to meet professional expectations, either in the moment (for minor or moderate single episodes of unprofessional behavior) or after the moment (for major single episodes or repeated minor to moderate episodes of unprofessional behavior)
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> Direct observation Global evaluation Multisource feedback Mentor and program director observations Oral or written self-reflection (e.g., of a personal or observed lapse, ethical dilemma, or systems-level factors) Simulation
<p>Curriculum Mapping</p>	<ul style="list-style-type: none">
<p>Notes or Resources</p>	<ul style="list-style-type: none"> American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2021. American Board of Internal Medicine, ACP-ASIM Foundation, European Federation of Internal Medicine. Medical professionalism in the new millennium: A physician charter. <i>Ann Intern Med.</i> 2002;136:243-246. http://abimfoundation.org/wp-content/uploads/2015/12/Medical-Professionalism-in-the-New-Millenium-A-Physician-Charter.pdf. 2021.

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- Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. McGraw-Hill Education; 2014. ISBN:978-0071807432.

Professionalism 2: Accountability and Conscientiousness Overall Intent: To take responsibility for one’s own actions and the impact on patients and other members of the health care team	
Milestones	Examples
<p>Level 1 <i>Responds promptly to instructions, requests, or reminders to complete tasks and responsibilities</i></p> <p><i>Understands the importance of well-defined workflow processes for laboratory efficacy and accurate patient reporting</i></p>	<ul style="list-style-type: none"> • Responds promptly to reminders from program administrator to complete work hour logs • Timely attendance at conferences • Responds promptly to requests to complete test reports for faculty review
<p>Level 2 <i>Takes appropriate ownership and performs tasks and responsibilities in a timely manner with attention to detail</i></p> <p><i>Participates in monitoring laboratory operations and assists to resolve workflow issues</i></p>	<ul style="list-style-type: none"> • Completes test reports in a timely manner and recognizes when there will be difficulty completing that task (e.g., going out of town, awaiting additional information from the laboratory), and knows deadline for completion of results • Completes cases (any) in a timely manner, with attention to detail, including reporting of all clinicopathologic correlations • Completes review of test results in advance of sign-out with attending • Completes communication, follow-up, and documentation of any clinical or quality improvement tasks assigned • Completes and documents safety modules, procedure review, and licensing requirements (e.g., administrative duties and tasks)
<p>Level 3 <i>Recognizes situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team</i></p> <p><i>Prepares and leads troubleshooting efforts to correct workflow problems</i></p>	<ul style="list-style-type: none"> • Appropriately notifies fellow learners during transition of care or hand-off to avoid patient safety issues and compromise of patient care • Completes tasks in stressful situations and preempts issues that would impede completion of tasks (e.g., notifies attending of multiple competing demands on-call, appropriately triages tasks, and asks for assistance from other residents or faculty members, if needed) • Reviews Case Logs, evaluations, and portfolio and develops a learning plan to address gaps/weakness in knowledge, case exposure, and skills
<p>Level 4 <i>Anticipates and intervenes in situations that may impact others’ ability to complete tasks and responsibilities in a timely manner</i></p>	<ul style="list-style-type: none"> • Identifies issues that could impede other learners from completing tasks and provides leadership to address those issues; escalates to communicating with program director if problem requires a system-based approach and needs addressing at a higher administrative level

<p><i>Critically evaluates workflows and proposes recommendations to accomplish desired goals</i></p>	<ul style="list-style-type: none"> • Takes responsibility for potential adverse outcomes from mishandled specimen and professionally discusses with the interprofessional team
<p>Level 5 <i>Designs and recommends new strategies to ensure that the needs of patients, teams, and systems are met</i></p> <p><i>Develops and implements process improvements across health care teams</i></p>	<ul style="list-style-type: none"> • Sets up a meeting with the lead technologist to streamline a reflex testing algorithm and follows through with a system-based solution • Leads team to find solutions to problem including a root cause analysis, brainstorming session, and quality improvement initiatives
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Compliance with deadlines and timelines • Direct observation • Mentor and program director observations • Multisource global evaluations, including from program administrator • Quality metrics of turnaround time on cases • Self-evaluations and reflective tools • Simulation
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Code of conduct from fellow/resident institutional manual • Expectations of residency program regarding accountability and professionalism

Professionalism 3: Self-Awareness and Help-Seeking Overall Intent: To identify, use, manage, improve, and seek help for personal and professional well-being for self and others	
Milestones	Examples
<p>Level 1 <i>With assistance, recognizes limitations in the knowledge, skills, and behaviors of oneself or team</i></p> <p><i>With assistance, recognizes status of personal and professional well-being</i></p>	<ul style="list-style-type: none"> • Requests feedback on areas of improvement • Proactively shares limitations in specific knowledge and skills • Accepts feedback and exhibits positive responses to criticism
<p>Level 2 <i>Independently recognizes limitations in the knowledge, skills, and behaviors of oneself or team and seeks help when needed</i></p> <p><i>Independently recognizes status of personal and professional well-being and seeks help when needed</i></p>	<ul style="list-style-type: none"> • Identifies possible sources of personal stress or lack of clinical knowledge and independently seeks help • Performs an ongoing assessment of personal and professional well-being
<p>Level 3 <i>With assistance, proposes and implements a plan to remediate or improve the knowledge, skills, and behaviors of oneself or team</i></p> <p><i>With assistance, proposes and implements a plan to optimize personal and professional well-being</i></p>	<ul style="list-style-type: none"> • With supervision, assists in developing a personal learning or action plan to address gaps in knowledge or stress and burnout for self or team
<p>Level 4 <i>Independently develops and implements a plan to remediate or improve the knowledge, skills, and behaviors of oneself or team</i></p> <p><i>Independently develops and implements a plan to optimize personal and professional well-being</i></p>	<ul style="list-style-type: none"> • Independently develops personal learning or action plans for continued personal and professional growth, and limits stress and burnout for self or team
<p>Level 5 <i>Serves as a resource or consultant for developing a plan to remediate or improve the knowledge, skills, and behaviors</i></p>	<ul style="list-style-type: none"> • Mentors colleagues in self-awareness and establishes health management plans to limit stress and burnout

<p><i>Coaches others when responses or limitations in knowledge/skills do not meet professional expectations</i></p>	<ul style="list-style-type: none"> • Helps others develop personal and professional development plans
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Group interview or discussions for team activities • Individual interview • Institutional online training modules • Mentor and program director observations • Participation in institutional well-being programs • Self-assessment and personal learning plan
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • This subcompetency is not intended to evaluate a fellow’s well-being. Rather, the intent is to ensure that each fellow has the fundamental knowledge of factors that affect well-being, the mechanisms by which those factors affect well-being, and available resources and tools to improve well-being. • ACGME. “Well-Being Tools and Resources.” https://dl.acgme.org/pages/well-being-tools-resources. Accessed 2022. • Conran RM, Zein-Eldin Powell S, Domen RE, et al. Development of professionalism in graduate medical education: A case-based educational approach from the College of American Pathologists’ Graduate Medical Education Committee. <i>Acad Pathol.</i> 2018;5:2374289518773493. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039899/. 2021. • Hicks PJ, Schumacher D, Guralnick S, Carraccio C, Burke AE. Domain of competence: personal and professional development. <i>Acad Pediatr.</i> 2014;14(2 Suppl):S80-97. https://www.academicpedsjnl.net/article/S1876-2859(13)00332-X/fulltext. 2021. • Joseph L, Shaw PF, Smoller BR. Perceptions of stress among pathology residents: survey results and some strategies to reduce them. <i>Am J Clin Pathol.</i> 2007;128(6):911-919. https://academic.oup.com/ajcp/article/128/6/911/1764982. 2021. • Local resources, including Employee Assistance program

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication	
Overall Intent: To deliberately use language in reports and communication with patients and their caretakers, identify communication barriers including self-reflection on personal biases and minimize them in the doctor-patient relationships; organize and lead communication around shared decision making	
Milestones	Examples
<p>Level 1 <i>Uses language and non-verbal behavior to demonstrate respect and establish rapport</i></p> <p><i>Identifies common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system</i></p>	<ul style="list-style-type: none"> • Self-monitors and controls tone, non-verbal responses, and language and asks questions to invite participation • Accurately communicates their role in the health care system • Identifies common communication barriers in patient care • Avoids medical jargon in specimen collection instructions, making sure communication is at the appropriate level to be understood by a layperson
<p>Level 2 <i>Establishes a relationship in straightforward encounters using active listening and clear language</i></p> <p><i>Identifies complex barriers to effective communication (e.g., health literacy, cultural differences)</i></p>	<ul style="list-style-type: none"> • Demonstrates active listening, attention to affect, and questions that explore the optimal approach to daily tasks • Recognizes health literacy issues and how they impact selection of language to report test results or communicating specimen collection plans • Understands that certain words or phrases in tests results may have a negative impact
<p>Level 3 <i>Establishes a relationship in challenging patient encounters, as appropriate</i></p> <p><i>When prompted, reflects on personal biases while attempting to minimize communication barriers</i></p>	<ul style="list-style-type: none"> • Demonstrates respect and compassion when reporting test results • Completes a module on recognizing implicit/unconscious bias
<p>Level 4 <i>Easily establishes relationships, with attention to patient/patient's family's concerns and context, regardless of complexity</i></p> <p><i>Independently recognizes personal biases while attempting to proactively minimize communication barriers</i></p>	<ul style="list-style-type: none"> • Is an active member of patient care team in discussion of test results and/or subsequent recommended studies • Participates in the sharing of test results in face of medical error • Reporting test results using language that can be understood by individuals at other levels of health literacy

<p>Level 5 <i>Mentors others in situational awareness and critical self-reflection to consistently develop positive therapeutic relationships</i></p> <p><i>Models self-awareness while teaching a contextual approach to minimize communication barriers</i></p>	<ul style="list-style-type: none"> • Leads the sharing of test results in face of medical error
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Self-assessment including self-reflection exercises • Simulation • Structured case discussions
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Dintzis SM. Improving pathologist’s communication skills. <i>AMA J Ethics</i>. 2016;18(8):802-808. https://journalofethics.ama-assn.org/article/improving-pathologists-communication-skills/2016-08. 2021. • Dintzis SM, Stetsenko GY, Sitlani CM, et al. Communicating pathology and laboratory errors: Anatomic pathologists’ and laboratory medical directors’ attitudes and experiences. <i>Am J Clin Pathol</i>. 2011;135(5):760-765. https://academic.oup.com/ajcp/article/135/5/760/1766306. 2021. • Harvard University. Project Implicit. https://implicit.harvard.edu/implicit/takeatest.html. 2021. • Laidlaw A, Hart J. Communication skills: An essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. <i>Med Teach</i>. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2021. • Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. <i>BMC Med Educ</i>. 2009;9:1. https://bmcmmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2021.

Interpersonal and Communication Skills 2: Interprofessional and Team Communication	
Overall Intent: To effectively communicate with the health care team (e.g., laboratory team, resident/fellow team, faculty/resident team, interdisciplinary care team, or any other functioning team in the program), including both inter- and intra-departmental and consultants, in both straightforward and complex situations	
Milestones	Examples
<p>Level 1 <i>Uses language that values all members of the health care team</i></p> <p><i>Describes the utility of constructive feedback</i></p>	<ul style="list-style-type: none"> • Shows respect in health care team communications through words and actions such as in requests for clinical consultation • Uses respectful communication with clerical and technical staff members • Listens to and considers others' points of view, is nonjudgmental and actively engaged, and demonstrates humility
<p>Level 2 <i>Communicates information effectively with all health care team members</i></p> <p><i>Solicits feedback on performance as a member of the health care team</i></p>	<ul style="list-style-type: none"> • Verifies understanding of communications within the health care team (e.g., closed-loop communications, restating for critical values and unexpected diagnoses, follows up in laboratory with technologists) • Demonstrates active listening by fully focusing on the speaker (other health care provider, technologist), actively showing verbal and non-verbal signs (eye contact, posture, reflection, questioning, summarization) • Communicates clearly and concisely in an organized and timely manner during consultant encounters, as well as with the health care team in general • Seeks feedback at sign-out
<p>Level 3 <i>Uses active listening to adapt communication style to fit team needs</i></p> <p><i>Integrates feedback from team members to improve communication</i></p>	<ul style="list-style-type: none"> • Verifies understanding of communications by restating critical values and unexpected diagnoses • Raises concerns or provides opinions and feedback when needed to others on the team • Respectfully provides feedback to more junior members of the medical team for the purposes of improvement or reinforcement of correct knowledge, skills, and attitudes, when appropriate
<p>Level 4 <i>Coordinates recommendations from different members of the health care team to optimize patient care</i></p> <p><i>Communicates feedback and constructive criticism to superiors</i></p>	<ul style="list-style-type: none"> • Offers suggestions to negotiate or resolve conflicts among health care team members; raises concerns or provides opinions and feedback, when needed, to superiors on the team • Adapts communication strategies in handling complex situations

<p>Level 5 Models flexible communication strategies that value input from all health care team members, resolving conflict when needed</p> <p><i>Facilitates regular health care team-based feedback in complex situations</i></p>	<ul style="list-style-type: none"> • Communicates with all health care team members, resolves conflicts, and provides feedback in any situation • Organizes a team meeting to discuss and resolve potentially conflicting points of view on a plan of care (e.g., molecular testing for a rare neurological condition, use of rare resources)
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Direct observation • Global assessment • Multisource assessment • Record or chart review for professionalism and accuracy in written communications • Simulation encounters
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Brissette MD, Johnson K, Raciti PM, et al. Perceptions of unprofessional attitudes and behaviors: implications for faculty role modeling and teaching professionalism during pathology residency. <i>Arch Pathol Lab Med</i>. 2017;141:1394-1401. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0477-CP. 2021. • Conran RM, Powell SZ, Domen RE, et al. Development of professionalism in graduate medical education: a case-based educational approach from the College of American Pathologists' Graduate Medical Education Committee. 2018;5:2374289518773493. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039899/. 2021. • Green M, Parrott T, Cook G. Improving your communication skills. <i>BMJ</i> 2012;344:e357. https://www.bmj.com/content/344/bmj.e357.abstract. 2021 • Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. <i>Med Teach</i>. 2013;35(5):395-403. https://pubmed.ncbi.nlm.nih.gov/23444891/. 2021. • Nakhleh RE, Myers JL, Allen TC, et al. Consensus statement on effective communication of urgent diagnoses and significant, unexpected diagnoses in surgical pathology and cytopathology from the College of American Pathologists and Association of Directors of Anatomic and Surgical Pathology. <i>Arch Pathol Lab Med</i>. 2012;136(2):148-154. https://meridian.allenpress.com/aplm/article/136/2/148/64793/Consensus-Statement-on-Effective-Communication-of. 2021. • Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. <i>Med Teach</i>. 2019;41(7):746-749.

<https://www.tandfonline.com/doi/abs/10.1080/0142159X.2018.1481499?journalCode=imte20>. 2021.

Interpersonal and Communication Skills 3: Communication within Health Care Systems Overall Intent: To effectively communicate using a variety of methods	
Milestones	Examples
<p>Level 1 <i>Safeguards patient personal health information (PHI) by communicating through appropriate means as required by institutional policy (e.g., patient safety reports, cell phone/pager usage)</i></p> <p><i>Identifies institutional and departmental structure for communication of issues</i></p>	<ul style="list-style-type: none"> • Identifies when it is acceptable to include protected health information in various forms of communication • Identifies institutional and departmental communication hierarchy for concerns and safety issues
<p>Level 2 <i>Appropriately selects forms of communication based on context and urgency of the situation</i></p> <p><i>Respectfully communicates concerns about the system</i></p>	<ul style="list-style-type: none"> • Identifies method for sharing results needing urgent attention • Recognizes that a communication breakdown has happened and respectfully brings the breakdown to the attention of the chief resident or faculty member • Reports a patient safety event
<p>Level 3 <i>Communicates while ensuring security of PHI, with guidance</i></p> <p><i>Uses institutional structure to effectively communicate clear and constructive suggestions to improve the system</i></p>	<ul style="list-style-type: none"> • Communicates opportunities for improvement in the laboratory information system (LIS)/EHR interface • Knows when to direct concerns locally, departmentally, or institutionally—i.e., appropriate escalation • Uses appropriate method when sharing results needing urgent attention
<p>Level 4 <i>Independently communicates while ensuring security of PHI</i></p> <p><i>Initiates conversations on difficult subjects with appropriate stakeholders to improve the system</i></p>	<ul style="list-style-type: none"> • Talks directly to a colleague about breakdowns in communication to prevent recurrence • Participates in task force to update policy for sharing abnormal results • Improves methods for communicating system-wide call schedules, conference scheduling, etc.
<p>Level 5 <i>Guides departmental or institutional communication around policies and procedures regarding the security of PHI</i></p>	<ul style="list-style-type: none"> • Leads a task force established by the hospital QI committee to develop a plan to improve house staff hand-offs

<p><i>Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field)</i></p>	<ul style="list-style-type: none"> • Works with information systems to implement improvements in the LIS/EHR interface
<p>Assessment Models or Tools</p>	<ul style="list-style-type: none"> • Chart review for documented communications • Observation of sign-outs, observation of requests for consultations • 360-degree evaluation of verbal communications
<p>Curriculum Mapping</p>	<ul style="list-style-type: none"> •
<p>Notes or Resources</p>	<ul style="list-style-type: none"> • Bierman JA, Hufmeyer KK, Liss DT, Weaver AC, Heiman HL. Promoting responsible electronic documentation: validity evidence for a checklist to assess progress notes in the electronic health record. <i>Teach Learn Med.</i> 2017;29(4):420-432. https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385. 2021. • Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. <i>Jt Comm J Qual Patient Saf.</i> 2006;32(3):167-175. https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext. 2021. • Starmer AJ, et al. I-pass, a mnemonic to standardize verbal handoffs. <i>Pediatrics.</i> 2012;129(2):201-204. https://pediatrics.aappublications.org/content/129/2/201?sso=1&sso_redirect_count=1&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token. 2021.

Molecular Genetic Pathology Supplemental Guide

To help programs transition to the new version of the Milestones, the ACGME has mapped the original Milestones 1.0 to the new Milestones 2.0. Indicated below are where the subcompetencies are similar between versions. These are not exact matches, but are areas that include similar elements. Not all subcompetencies map between versions. Inclusion or exclusion of any subcompetency does not change the educational value or impact on curriculum or assessment.

Milestones 1.0	Milestones 2.0
PC1: Assay Design and Validation	MK4: Assay Design and Verification/Validation
PC2: Quality Assurance	PC1: Quality Assurance and Quality Management
PC3: Interpretation	PC2: Interpretation of Molecular and Genetic Testing
MK1: Molecular Testing	MK1: Molecular Testing with Various Platforms
MK2: Genomic Testing	MK2: Genomic Testing, Genomic Databases, and Bioinformatics
MK3: Patient-Centered Interpretation	MK3: Patient-Centered Interpretation
SBP1: Regulatory	SBP5: Accreditation, Compliance, and Quality
SBP2: Health Care Teams	PC3: Interdisciplinary Consultation
	SBP2: Systems Navigation for Patient-Centered Care
	SBP3: Community Health
	SBP4: Physician Role in Health Care System
PBL1: Evidence-based Utilization	SBP6: Utilization
	PBL1: Evidence-Based Practice and Scholarship
PBL2: Process Improvement and Patient Safety	SBP1: Patient Safety and Quality Improvement
	PBL2: Research
PROF1: Giving and Receiving Feedback	PBL3: Reflective Practice and Commitment to Personal Growth
	ICS2: Interprofessional and Team Communication
PROF2: Accountability, Honesty, and Integrity	PROF1: Professional Behavior and Ethical Principles
	PROF2: Accountability and Conscientiousness
	PROF3: Self-Awareness and Help-Seeking
ICS1: Communication with Patients, Families, and Health Care Providers	ICS1: Patient- and Family-Centered Communication
	ICS2: Interprofessional and Team Communication
	ICS3: Communication with Health Care Systems
ICS2: Personnel Management and Conflict Resolution	ICS2: Interprofessional and Team Communication

Available Milestones Resources

Milestones 2.0: Assessment, Implementation, and Clinical Competency Committees Supplement, 2021 - <https://meridian.allenpress.com/jgme/issue/13/2s>

Milestones Guidebooks: <https://www.acgme.org/milestones/resources/>

- *Assessment Guidebook*
- *Clinical Competency Committee Guidebook*
- *Clinical Competency Committee Guidebook Executive Summaries*
- *Implementation Guidebook*
- *Milestones Guidebook*

Milestones Guidebook for Residents and Fellows: <https://www.acgme.org/residents-and-fellows/the-acgme-for-residents-and-fellows/>

- *Milestones Guidebook for Residents and Fellows*
- *Milestones Guidebook for Residents and Fellows Presentation*
- *Milestones 2.0 Guide Sheet for Residents and Fellows*

Milestones Research and Reports: <https://www.acgme.org/milestones/research/>

- *Milestones National Report*, updated each fall
- *Milestones Predictive Probability Report*, updated each fall
- *Milestones Bibliography*, updated twice each year

Developing Faculty Competencies in Assessment courses - <https://www.acgme.org/meetings-and-educational-activities/courses-and-workshops/developing-faculty-competencies-in-assessment/>

Assessment Tool: Direct Observation of Clinical Care (DOCC) - <https://dl.acgme.org/pages/assessment>

Assessment Tool: Teamwork Effectiveness Assessment Module (TEAM) - <https://team.acgme.org/>

Improving Assessment Using Direct Observation Toolkit - <https://dl.acgme.org/pages/acgme-faculty-development-toolkit-improving-assessment-using-direct-observation>

Remediation Toolkit - <https://dl.acgme.org/courses/acgme-remediation-toolkit>

Learn at ACGME has several courses on Assessment and Milestones - <https://dl.acgme.org/>