Special Article

Competency-Based Education for the Molecular Genetic Pathology Fellow

A Report of the Association for Molecular Pathology Training and Education Committee

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The following report represents guidelines for competency-based fellowship training in Molecular Genetic Pathology (MGP) developed by the Association for Molecular Pathology Training and Education Committee and Directors of MGP Programs in the United States. The goals of the effort were to describe each of the Accreditation Council for Graduate Medical Education competencies as they apply to MGP fellowship training, provide a summary of goals and objectives, and recommend assessment tools. These guidelines are particularly pertinent to MGP training, which is a relatively new specialty that operates within a rapidly changing scientific and technological arena. It is hoped that this document will provide additional material for directors of existing MGP programs to consider for improvement of program objectives and enhancement of evaluation tools already in place. In addition, the guidelines should provide a valuable framework for the development of new MGP programs. (J Mol Diagn 2009, 11:497–507; DOI: 10.2353/jmoldx.2009.090040)

The Accreditation Council for Graduate Medical Education (ACGME) Outcomes Project (<http://www.acgme.org/outcome>, last accessed April 10, 2009) is a long-term effort designed to improve the process of educating residents and fellows. Central to this effort is the utilization of competency-based education and outcomes assessment at both the individual and program level. Competency-based education involves specific learning objectives around which a curriculum is designed and against which each trainee's progress is assessed. Residents must demonstrate performance at the level of a new practitioner in six general competencies: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice (Table 1).

The Outcomes Project has a multiyear timetable (http://www.acgme.org/outcome/project/timeline/TIMELINE_index_frame.htm, last accessed April 10, 2009). Phase I (7/01-6/02) was the initial response period when programs were required to define specific objectives for resident education in the competencies and to review the evaluation process. Phase II (7/02-6/06) was a time frame for developing learning opportunities and assessment

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Table 1. ACGME Requirements for Competency and Evaluation of Residents*

<p>Programs must define specific knowledge, skills, and attitudes required and provide educational experiences as needed for their residents in the following areas:</p> <p>Patient Care that is compassionate, appropriate, and effective for treatment of health problems and promotion of health.</p> <p>Medical Knowledge of established and evolving biomedical, clinical, and cognate sciences and its application to patient care.</p> <p>Practice-Based Learning and Improvement involving investigation and evaluation of patient care, appraisal and assimilation of scientific evidence, and implementation of improvements in patient care.</p> <p>Interpersonal and Communication Skills that result in effective information exchange and teaming with patients, their families, and health professionals.</p> <p>Professionalism through commitment to professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.</p> <p>Systems-Based Practice that demonstrates an awareness of and responsiveness to the health care system and ability to utilize resources effectively to provide optimal patient care.</p>

*Modified after ACGME Outcome Project (<http://www.acgme.org/outcome/comp/compMin.asp>, last accessed April 10, 2009).

tools in the six competencies. Aggregate resident performance data were also to be reviewed by the institution's Graduate Medical Education Committee. As of this writing, we are in Phase III (7/06-6/11), when resident performance data are to be used for improving the program. Additionally, external measures such as quality indicators, posttraining employer evaluations, and standardized testing are to be used to establish resident and program performance. Phase IV (7/11 and beyond) will emphasize identification of best practices and benchmark programs with generalization of excellence in medical education.

In response to the Outcomes Project, the 2003 Training and Education Committee of the Association of Molecular Pathology (AMP) initiated a programmatic response to competency-based education for Molecular Genetic Pathology (MGP) fellows. On the basis of subsequent presentations and discussions at the 2005 and 2006 AMP MGP Fellowship Program Directors meetings, it was decided that a fundamental document on competencies would benefit all MGP fellowship programs. This resulting document describes each of the competencies as it applies to fellowship training in MGP, provides a summary of goals and objectives, and recommends assessment tools. It is anticipated that although this document will not directly match each program's capabilities due to the unique nature of each of our educational settings, the general educational process will be similar in all programs.

Goals and objectives serve to clarify the educational purpose. In this article, goals serve to describe the big picture, whereas objectives describe the specific knowledge and abilities that a fellow is expected to acquire during training. Objectives are most useful when they are specific, assessable, and directly linked to a particular curricular experience. This article provides goals for each of the competencies. Each training program should de-

velop objectives appropriate for the goals and a set of learning experiences (a curriculum) that will allow a fellow to accomplish the objectives. There may be overlap between the goals detailed for each of the six competencies since the knowledge, skills, and attitudes described by the goals are essentially the practice of MGP. The design and structure of evaluation tools required to document MGP fellow performance may be based on existing institutional or departmental formats but are best drafted to address the specific needs of individual MGP programs. Institutions developing new programs should consider contacting Pathology Residency Coordinators or MGP Program Directors from other programs to obtain specific examples and formats that may provide further guidance in drafting the necessary evaluation checklists, instruments, and portfolios.

Patient Care

Fellows must demonstrate a satisfactory level of diagnostic competence and the ability to provide appropriate and effective consultation in the context of MGP services.

Description of Patient Care in MGP

Typically, the MGP fellow does not have day-to-day physical interaction with patients as seen in the clinical realm of medicine. However, the fellow must work as a member of the patient care team through use of available molecular genetic tools combined with diagnostic competence and skillful consultation.

The patient care role of the MGP fellow has several facets. Clinical knowledge of the patient is one of the most important parts of this responsibility. The fellow is part of a team making informed decisions about diagnostic and therapeutic interventions based on patient information. Thus, the fellow must gather essential and accurate information about the patient. This might require review of electronic medical records for clinical history and physical findings, the results of prior molecular tests, or findings from radiology, anatomical pathology, clinical hematology, and flow cytometry to complete the clinical picture of the patient's presentation. On occasion, the MGP fellow will need to discuss the patient's case with the attending physician, consultants, or ancillary services.

Ultimately, the patient information obtained should be logical, precise, and appropriate for the situation. Using the information, the fellow can then function as a consultant to the clinician. This task includes explanation of test indications, methods, technical aspects, and/or interpretations of molecular assays or genetic tests. The fellow should be able to suggest appropriate tests that need to be performed for the patient and discuss why other testing may not be indicated. With the rapid changes in the molecular diagnostics field, many clinicians may not be familiar with the range of assays offered or their application. Providing the most timely information of current testing requires knowledge of the current literature and contact with molecular genetic colleagues and computer resources, such as the AMP listserv (CHAMP), the AMP Test Directory (<http://www.amptestdirectory.org>), Lab

Tests Online (<http://labtestsonline.org>), GeneTests (<http://www.genetests.org>), and Online Mendelian Inheritance of Man (<http://www.ncbi.nlm.nih.gov/omim/>) (all web links last accessed April 10, 2009).

For example, if a clinician believes that a patient needs an inherited thrombophilia workup, the MGP fellow should be able to explain components of the disease, such as the genetics (genotype), clinical expression (phenotype), test methods, and interpretation of results. As the situation warrants, the MGP fellow may need to provide the latest clinical or pathology literature to the health care professional. This value-added approach is very important for clinicians given the vast amount of information available and the rapidly changing pace of today's medical practice. Potentially, technical issues may need to be discussed with the clinician, such as assay performance characteristics, including reproducibility, sensitivity, and specificity. Occasionally, the clinician will need to gain understanding of rudimentary aspects, such as how to order a particular test, the appropriate type of specimen or blood collection tube, and appropriate conditions for storage and transport to the molecular genetics laboratory. Regardless of the reason for the interaction, the fellow should demonstrate effective consultation and education to the clinician.

Depending on the assays offered by the laboratory, the fellow may need to maintain close contact with members of the health care team in reporting time-sensitive laboratory results. For instance, the results of infectious disease testing may necessitate an immediate change in therapy.

Summary of Goals

- Gather essential and accurate patient information, especially data from other pathology and laboratory services.
- Contact clinicians, as appropriate, for information on patient history.
- Make informed test/assay recommendations based on clinical information, cost-effectiveness of testing and knowledge of available testing.
- Advise health care professionals about the variety of assays appropriate for the disease or health concern and assist in interpreting assay results.
- Offer education and consultation services in MGP to health care providers.
- Contact clinicians with results of time-critical assays, especially those that will drive immediate clinical or therapeutic decisions.

Tools to Assess Patient Care

360° Evaluation Instrument

A 360° global rating is an effective assessment tool for evaluating the competency of an MGP fellow in patient care. Such an evaluation should involve placing patient care evaluation points into a questionnaire with a rating scale, usually based on five or nine total points. Although

many evaluation forms are based on check boxes or numerical scores, it is important to obtain written comments on the fellow's performance where possible; evaluators should be encouraged to provide a thoughtful narrative evaluation, although obtaining such is often a significant challenge. Faculty, laboratory technologists, and management staff who interact with the fellow in the laboratory and on extramural rotations should serve as evaluators; however, input from medical personnel outside of the laboratory and other trainees may also be desirable. Citation of specific examples demonstrating abilities in patient care is valued and should be encouraged.

Checklist Evaluation

The checklist evaluation is designed to gather yes and no answers about specific habits, behaviors, or activities. This evaluation system can be used to assess patient care segmented into specific action items or behaviors.

Portfolio

The fellow should continuously maintain a portfolio of cases or activities that provides evidence of accomplishment in patient care. Since case logs are already a requirement for MGP fellows, the portfolio assessment can easily build on this compulsory recordkeeping. Case logs should incorporate anonymized clinical and laboratory data on patients and notes regarding conversations with clinicians, as appropriate. In addition, lecture slides and notes from tumor boards, core conferences, or other educational venues in which the fellow participated should be documented.

Sample Evaluation Questions for Assessing Patient Care

1. Does the fellow routinely contact physicians or health care team members for patient information on time-critical assays?
2. Does the fellow routinely request pathology reports for paraffin blocks submitted to the laboratory for analysis to assure that the tissue matches the patient?
3. Does the fellow review reports for flow cytometry, immunophenotyping, pathology, and cytopathology when applicable for patients undergoing important assays? Are such details summarized and conveyed to the clinician or team caring for the patient?
4. Does the fellow document important facts relevant to the care of the patient?
5. Does the fellow use information technology and other data resources to help find the latest assays or patient educational material?
6. Does the fellow take the time to explain an assay or interpretation to those unfamiliar with the process?
7. Does the fellow reliably communicate results of critical assays to clinicians and/or house staff in a timely fashion?

8. Does the fellow carefully check drafts of molecular reports before sign-out?
9. While in the clinic, does the fellow help develop patient management plans and contribute complete information for appropriate testing options?

Medical Knowledge

Fellows must demonstrate acquisition and application of the principles and practice of MGP, including the basic science of molecular genetics, test methodology, laboratory management, and the clinical pathological correlation with various scenarios in infectious, hematological, oncologic, and genetic diseases.

Description of Medical Knowledge in MGP

The medical knowledge required to practice MGP is broad and rapidly evolving. Accordingly, the fellow must be familiar with the basic science and laboratory methodologies that form the basis of current molecular laboratory practice. In addition, the fellow must develop the skills needed to continually evaluate new scientific and medical information pertinent to the practice of MGP using evidence-based medicine. The fellow must demonstrate knowledge of the principles of nucleic acid biochemistry, including structure and function, hybridization, replication, mutation, and repair. The fellow also must have an understanding of the techniques for nucleic acid handling, processing, and enzymatic and chemical manipulation. The fellow should be familiar with standard techniques of molecular testing, including amplification technologies, gel and capillary electrophoresis, sequencing, Southern blotting, microarrays, comparative genomic hybridization, bright-field and fluorescence *in situ* hybridization, cytogenetics, DNA methylation, microsatellite instability, loss of heterozygosity, and identity determination. Moreover, the fellow should demonstrate hands-on proficiency at basic molecular laboratory techniques, such as nucleic acid extraction, electrophoresis, qualitative and quantitative PCR, DNA sequencing, and *in situ* hybridization. This can be achieved through test development and validation, performance of routine testing in a teaching mode, and/or research activities. A strong comprehension of molecular laboratory techniques will enable the fellow to troubleshoot assays effectively and apply appropriate rigor to test development and validation procedures.

Comprehension of medical laboratory operations and regulations is critical to adept medical direction and oversight of MGP testing. Therefore, the fellow should understand the principles of laboratory quality control (QC), quality assurance (QA), and test validation as well as demonstrate familiarity with general personnel requirements, ethical issues, confidentiality, and laboratory and patient safety issues. In addition, the fellow must have a basic understanding of regulatory requirements applicable to MGP as set forth by the Clinical Laboratory Improvement Amendments of 1988, the College of American Pathologists laboratory checklists, the Joint Commission, the U.S. Occu-

pational Safety and Health Administration, and the U.S. Food and Drug Administration.

To function as a clinical consultant, the fellow must understand the indications and clinical implications involved in molecular testing related to various hematopoietic diseases (eg, *BCR/ABL1*, Ig and T cell receptor gene rearrangements), solid tumors (eg, *MYCN*, 1p19q, *HER2*), cardiovascular disease and coagulation (eg, *F2* 20210G>A, *F5* Leiden), infectious disease (eg, HIV and hepatitis C virus diagnostic and viral load), and inherited genetic disorders (eg, cystic fibrosis, hemochromatosis, fragile X syndrome). To communicate effectively in this capacity, the fellow must also develop facility with the standardized nomenclature of MGP, including precise description of DNA sequence variants and mutations.

Summary of Goals

- Demonstrate mastery of the science of MGP, including nucleic acid structure and function, and mutations/ variations, and use appropriate/accurate descriptive nomenclature.
- Demonstrate an understanding of standard molecular laboratory techniques.
- Demonstrate technical proficiency in nucleic acid extraction, electrophoresis, qualitative and quantitative amplification technologies, DNA sequencing, and *in situ* hybridization.
- Demonstrate an understanding of basic principles of laboratory management, including QC, QA, test validation, budgeting, personnel requirements, regulatory agencies and requirements, ethical issues, and laboratory and patient safety.
- Understand indicators, clinical implications, methodologies, and limitations of testing for a wide range of clinical disorders, including solid tumors, hematopoietic neoplasms, infectious diseases, coagulopathies, and inherited genetic disorders.
- Understand principles and indications for pharmacogenetic testing and gene-targeted therapeutics.

Tools to Assess Medical Knowledge

Testing

Oral or written examination can be an integral part of the fellowship experience and may be designed on a rotation-to-rotation basis or designed as a periodic and graduated test of general proficiency. Feedback of testing results to the fellow can result in focused study and/or remediation.

Checklist Evaluation

A checklist of medical knowledge topics and assays is a good way to assess comprehension and understanding. This can be accomplished with a listing of didactic areas with sign-off by assessing personnel. Alternatively, this can be done as a form of self-assessment to ensure completeness of training.

Portfolio

Maintenance of a log of educational sessions, including content and competencies addressed, is a good way to document medical knowledge as well as other competencies and ensures complete coverage of the subject matter.

Sample Evaluation Questions for Assessing Medical Knowledge

1. Does the trainee understand the general principles regarding the structure and function of DNA and RNA, including principles of hybridization?
2. Can the trainee explain general MGP principles using appropriate terminology?
3. Does the trainee understand basic molecular techniques, including PCR, sequencing, electrophoresis, microarrays, and *in situ* and blot hybridization and applications, such as microsatellite instability, loss of heterozygosity, DNA methylation, and identity determination?
4. Does the trainee understand the basic principles of molecular laboratory management, including QC, QA, test validation, personnel requirements, regulatory agencies and requirements, ethical issues, and laboratory and patient safety?
5. Does the trainee understand how to function as an effective consultant for a broad variety of clinical conditions that may be detected by MGP methods, including solid tumors, hematopoietic tumors, cardiovascular disease, coagulation, infectious disease, and genetic disorders?
6. Does the trainee understand the clinical applications for pharmacogenetic testing and gene-targeted therapeutics?

Practice-Based Learning and Improvement

Fellows must demonstrate the ability to investigate and evaluate their diagnostic and consultative practices, appraise and assimilate scientific evidence, and improve their patient care practices.

Description of Practice-Based Learning and Improvement in MGP

MGP is evolving with an increasing understanding of disease processes at the molecular level and with an increasing array of available information and technology. MGP professionals must be able to integrate the current understanding of the molecular basis of disease with a wide array of analytical information and emergent technologies. It is through continued learning, development of collaborations with colleagues, and integration with the scientific community that the fellow will grow and develop expertise in molecular pathology beyond the years of the fellowship. Consequently, any practitioner of MGP is obligated to continuously augment and revise his/her knowledge.

Membership and participation in professional organizations devoted to MGP and interaction and communication with colleagues in the field are essential to continued growth as a practitioner of the discipline. The practice of MGP can provide data essential to the care of patients in virtually every recognized subspecialty of medicine and science. The MGP trainee is advised to maintain an awareness of developments and practices in basic science and clinical specialties, such as biochemistry, forensics, cell biology, neurology, genetics, chemistry, etc. This can be accomplished through web-based journal reviews (eg, Medscape, <http://www.medscape.com>, last accessed April 10, 2009), regular reading of appropriate journal articles, attending national and local professional society meetings and institutional lectures, and active engagement of nonpathology clinical colleagues.

It is expected that the MGP trainee will develop the facility to read and evaluate scientific studies critically using the tools of evidence-based medicine and will assimilate the abstracted information into their knowledge and practice. Ultimately, the trainee must be able to apply that knowledge to specific circumstances, whether that involves development and implementation of a new technique or assay or the interpretation of specific test results and consequences for a particular patient.

The trainee should conduct periodic assessments of laboratory data as part of the continued validation of assays and improvement of laboratory practices. Participation in specific focused reviews of laboratory data may reveal important issues in specimen processing, analysis, and result reporting. Analyzed data should be compared with recent clinical literature, as appropriate, to ensure currency and appropriateness of tests.

The MGP trainee should strive to develop a broad technical understanding of the methodologies frequently used for molecular genetic testing. Many of these tests are developed within each laboratory and understanding the strengths and limitations of a particular analytical method is essential. A working knowledge of test development and validation is a prerequisite, and it is reasonable to expect the trainee to demonstrate the ability to develop and validate a laboratory-developed assay during fellowship training. Such test validation exercises impart a deeper understanding of an assay, which aids in dealing with inherent nuances of assay performance and interpretation.

The MGP trainee should recognize as intrinsic to their professional responsibility, the need to educate their laboratory coworkers, other pathologists, and their clinical colleagues. This can be accomplished directly by active participation in clinical conferences, lectures, journal clubs, and discussions in small group settings and with individuals.

Summary of Goals

- Demonstrate involvement in professional societies.
- Demonstrate ongoing self-education in sciences and clinical fields related to MGP.
- Demonstrate an understanding of clinical test development and validation procedures.

- Demonstrate willingness to educate and instruct others in matters related to MGP.
- Demonstrate the ability to ask a definable question, search for relevant scientific information, appraise the information using the principles of evidence-based medicine, and apply the results to clinical practice.

Tools to Assess Practice-Based Learning and Improvement

360° Evaluation Instrument

A global evaluation of general and specific performance and knowledge is useful and appropriate. Input from faculty, laboratory technologists and administrative personnel, other trainees, and other medical personnel outside of the laboratory may be desirable. Citation of involvement in professional societies, teaching opportunities, involvement in clinical conferences, involvement in research and development efforts, and scientific publications are all valuable indicators.

Portfolio

Maintenance of a log of education and scientific presentations is a good way to document this activity. A listing of regularly attended clinical conferences, journal clubs, and scientific meetings, copies of trainee authored procedures or policies, test validation summaries and associated laboratory data, and results of focused studies of laboratory data could be included.

Critically Appraised Topics

The development of a "critically appraised topic" involving appraisal and synthesis of a specific clinical question with evaluation of available literature to provide an evidence-based best solution allows the fellow to demonstrate his/her ability to use the tools of evidence-based medicine. Critically appraised topics provide a framework for development of best medical practice by formulating focused critical questions, reviewing the literature, and summarizing available research evidence on specific topics.¹ A variety of resources and templates for the development of critically appraised topics are available online and can be easily adopted as MGP learning tools.²

Sample Evaluation Questions for Assessing Practice-Based Learning

1. Does the trainee recognize a responsibility to be active in professional societies related to MGP?
2. Does the trainee recognize a general responsibility to advance the field of MGP?
3. Does the trainee demonstrate an ability to enhance his/her own education independently?
4. Does the trainee recognize the responsibility to educate others in matters related to MGP?
5. Does the fellow use appropriate resources on a regular basis to find the latest literature, methods, and clinical research in molecular diagnostics and medical/human genetics?
6. Is the trainee able to read and critically assess the scientific and clinical literature related to MGP using the principles of evidence-based medicine?
7. Does the fellow have the ability to answer questions and solve problems related to the practice of MGP based on the latest scientific evidence?

Interpersonal and Communication Skills

Fellows must demonstrate interpersonal and communication skills that result in effective information exchange and teaming with other health care providers, laboratory personnel, patients, and patients' families.

Description of Interpersonal and Communication Skills in MGP

Interpersonal and communication skills are important in all areas of medicine for effective interaction with patients and other health care professionals. The MGP fellow is expected to establish good working relationships with people in a variety of positions within and outside the health care system. The individuals will include clinicians from within the system and from outside who consult with the molecular laboratory before, during, and after evaluation of patients to provide reports of the progress of laboratory testing and interpretation of the test data within the context of the patient's clinical condition. In these cases, the fellow must be able to provide accurate information to the person inquiring about the status of the MGP testing and, through excellent interpersonal skills, convey this information as a consultant. The fellow should also directly interact with molecular genetic pathologists and laboratory directors at other institutions when referring tests, consulting on specific cases or arranging laboratory sample exchanges. The fellow should interact with clinical and pathology peers, as a consultant, a teacher, and a colleague. The fellow should also demonstrate effective working relationships with laboratory technical staff. In these interactions, it is particularly important for the fellow to exhibit excellent interpersonal skills that enable him or her to be a member or, in some instances, the leader of the team. During the course of training, the fellow should be expected to transition from a learning position in the laboratory to a junior laboratory director, with appropriate and excellent leadership skills.

Effective communication requires that the fellow be able to transmit precise and specific information in both verbal and written forms to laboratory technologists, clinicians, other health care workers, and the patient. The fellow must be able to communicate effectively and discreetly to maintain confidentiality with various individuals to obtain sensitive and relevant clinical information regarding a patient to determine appropriateness of an ordered test or to correlate with laboratory findings. The fellow must be able to assess another individual's knowl-

edge level about a particular test at the beginning of any conversation regarding pre- or posttesting analysis to convey information effectively. The fellow must communicate the details of genetic testing related to a particular case, particularly focusing on interpreting and explaining equivocal results and any false-negative and false-positive information to clinicians. A firm understanding of the technical aspects of molecular assays is critical for the fellow in dealing with nuances of assay performance and interpretation and is especially important for effective consultation and communication of results of complex cases. The fellow must communicate with laboratory personnel on a regular basis and must be able to troubleshoot, guide, and direct laboratory activities in an appropriate and team-sensitive manner. Also, the fellow must be an effective communicator in written material, particularly in the generation of reports and comments regarding specific test results. The fellow should demonstrate additional skills in writing laboratory protocols and scientific articles under the guidance of the laboratory director.

Finally, the fellow should participate in formal presentations and demonstrate excellent communication skills for presentations within the institution and at local or national meetings. Occasionally, the fellows will communicate with patients or their families directly. In these instances, the fellow must demonstrate sensitivity and care and must participate in these direct communications only under the direction and guidance of the patient's clinician and/or the molecular diagnostics faculty.

Summary of Goals

- Demonstrate effective working relationships with laboratory technical staff, departmental faculty and residents, extradepartmental faculty and staff, and outside consultants.
- Develop effective verbal communication skills, including the ability to communicate with clinicians at the appropriate level for the information being transmitted, the ability to convey and explain test results clearly, precisely, and concisely, and the ability to communicate effectively with technical personnel when troubleshooting and managing the laboratory.
- Develop excellent written skills for communication of complicated results when issuing reports, for the development and implementation of new laboratory policies and procedures, and for presentation of scientific research data, as appropriate.
- Develop presentation skills that include selection of appropriate presentation materials and visual aids, good oral presentation and mannerisms, and the ability to answer questions effectively.

Tools to Assess Interpersonal and Communication Skills

360° Evaluation Instrument

Because the fellow interacts with many people in many different positions, a global 360° is recommended. The

evaluation should include a broad sampling of the people with whom the fellow interacts, including laboratory personnel. It is particularly important to know how individuals other than the molecular diagnostics faculty view the fellow's communication and interpersonal skills, so input from clinicians and nurses or others outside of the laboratory is particularly desirable. Direct observation should also be used, particularly when the fellow is communicating results to clinicians or support staff and helping them to understand complex results.

Presentation Skills

Presentation skills can be assessed by directly evaluating the fellow at conferences.

Sample Evaluation Questions for Assessing Interpersonal Skills

1. Does the fellow demonstrate good relationships with other members of the health care team, exhibited by regular and excellent verbal communication and responsiveness to their calls or requests?
2. Does the fellow demonstrate appropriate team management and leadership skills within the laboratory?
3. Does the fellow demonstrate sensitivity and respect for the technical staff within the laboratory, with the development of appropriate relationships?
4. Is the fellow able to learn from the technical staff, ask appropriate questions, and demonstrate respect for their knowledge?
5. Does the fellow demonstrate effective relationships with the molecular diagnostics faculty and respond appropriately to constructive criticism and verbal instructions?

Sample Evaluation Questions for Assessing Communication Skills

1. Is the fellow able to present assay data to the molecular diagnostics faculty member completely and effectively and to provide an analysis of the results within the context of the clinical situation?
2. Is the fellow able to recognize his/her limitations in understanding complex cases and seek advice or help from the molecular diagnostics faculty before communicating results to referring physicians?
3. Is the fellow's level of comfort in communication demonstrating improvement over the course of training?
4. Is the fellow able to act as a consultant in explaining test results accurately and in a manner that is appropriate to the level of understanding of the person requesting the results?
5. Is the fellow able to write concise reports with appropriate comments?
6. Is the fellow able to compile an effective written protocol or policy document?

7. Does the fellow communicate effectively with the laboratory technical staff regarding troubleshooting, repeat testing, and workload management?
8. Is the fellow able to communicate effectively and appropriately with individuals at all levels of patient care within the hospital?
9. Are the fellow's presentations appropriate in scope and detail, professional in appearance and delivery, and effective in delivery style and objective?

Professionalism

Fellows must demonstrate a commitment to professional responsibilities, adherence to highest ethical standards, and respect for all.

Description of Professionalism in MGP

The Medical Professionalism Project, which included members of nine countries, was launched in 1999 to establish a set of principles for all medical professionals. The project defines professionalism as "the basis of medicine's contract with society" and has published a charter for medical professionalism.³ The charter describes patient welfare, autonomy, and social justice as the fundamental principles. Although it is assumed that every medical professional would take these principles to heart, competency evaluations during training should include assessment of adherence to these principles.

The MGP fellow must show professional competence in provision of services and must provide those services with respect for the patient and for all involved in patient care. The clinical responsibilities are to be consistently fulfilled with dedication and commitment to the best interests of the patient. Integrity and empathy are paramount in excellent patient care. Finally, continuous professional development by commitment to acquisition of scientific knowledge and education of others is essential for improving quality of care. The "physician's charter" has been used as a template to develop the following set of professionalism competencies for MGP fellowship training.

Respect and Compassion for the Patient

The fellow must demonstrate compassion and respect for the patient. By doing so, the fellow acknowledges that every specimen is not just a name and a number but represents a person. The MGP fellow must treat the patient's decisions with respect and provide understanding of laboratory findings that are appropriate for each patient's capabilities. On clinical rotations, the fellow must show sensitivity and respect for the culture, age, gender, and physical or mental disabilities of patients. Although the fellow is not the primary caregiver to the patients, empathy for them is crucial. Talking with patients and identifying their thoughts, emotions, and concerns provides better care of the patient.

Integrity and Honor

Integrity is essential to gaining and keeping the trust of patients, medical professionals, and society at large. The fellow must be honest. Any miscommunications or errors in the reporting of test results must be immediately brought to the attention of the laboratory director. The fellow should realize that medical errors do sometimes occur, and his/her prompt acknowledgment may mitigate their effect on patient care and may act to protect the trust of the caregivers.

A conflict of interest may arise from interactions with industry and for-profit organizations. The fellow must recognize that these interactions may have an impact on patient care, and any personal gain while rendering professional duties must be fully disclosed.

The fellow must demonstrate commitment to patient confidentiality and should only disclose patient information to those responsible for patient care and in keeping with Health Insurance Portability and Accountability Act guidelines. Confidentiality is paramount when having discussions with colleagues in public places as well as during seminars and conferences.

Teaching

The fellow should manifest interest and commitment to teaching assignments and should be actively involved in the education of other health care professionals. The education of other health care professionals should include both informal interactions with laboratory technologists and residents on rotation in the laboratory as well as more formal continuing education presentations to the faculty and staff of the MGP department and other departments within the institution.

Responsibility and Leadership

The fellow should actively assume appropriate responsibility and leadership roles. In health care today, patient care is shared with other medical professionals, which diffuses overall responsibility for the patient; however, the responsibility of the fellow in this setting can be defined. The fellow is responsible for patient care, laboratory management, and personal safety. The first responsibility includes collection of relevant patient information for timely and accurate interpretation of test results and working collaboratively with others to reduce the chances of medical error. As a "director in training," the fellow should also actively assume leadership and management roles for various aspects of the laboratory, as appropriate for the organizational structure of the laboratory and the level of training of the fellow. Graduated responsibilities in test development and implementation, QC and QA, laboratory administration and accreditation, and education and training of personnel should be assumed over the course of training. Finally, attention must always be given to personal safety and safety of others in the work environment. Universal precautions must be practiced at all times to prevent injury or infection. All acci-

dents, including exposures and spills, must be handled in a responsible manner and promptly reported to the assigned personnel.

Professional Growth and Development

The fellow should commit to excellence in the discipline of MGP and pursue continuing growth in understanding the complexity of health care issues at the institutional, regional, and national levels. The fellow should remain abreast of scientific and technological advances in the field of MGP, bringing new ideas to the laboratory and implementing new technologies. The fellow should also engage in scientific endeavors and add to the body of medical knowledge by conducting basic or clinical research.

Summary of Goals

- Demonstrate respect and compassion for the patient.
- Conduct himself/herself with integrity and honor.
- Educate other health care professionals in aspects of MGP.
- Actively assume responsibility and leadership roles.
- Pursue continuing professional growth and educational opportunities.

Tools to Assess Professionalism Competencies

360° Evaluation Instrument

A 360° global rating is an appropriate assessment tool for evaluating the professionalism competency of the fellow. This can be done using a questionnaire with a rating scale. The evaluators can be faculty as well as laboratory supervisors and other staff that interact with the fellow on a regular basis. Input from other trainees and medical personnel outside of the laboratory may also be desirable.

Checklist Evaluation

A checklist is of value in evaluating professionalism, with emphasis on general behavior and attitude reflected in day-to-day activities. Various components of the goals of professionalism described above can be itemized and evaluated with a "Yes/No" choice.

Sample Evaluation Questions for Assessing Professionalism

1. Does the fellow show respect for the patient and those involved in patient care, including laboratory staff, residents, and other medical professionals?
2. Does the fellow routinely demonstrate empathy and courtesy to the patients when interacting with them?
3. Does the fellow show integrity in reporting any errors committed in test utilization, result interpretation, or in communication of results?
4. Does the fellow appropriately disclose any conflict of interest?
5. Does the fellow apply the principle of patient confidentiality in all cases and situations?
6. Does the fellow show punctuality in reporting for work and educational activities?
7. Does the fellow educate personnel in the molecular laboratory as well as residents and laboratory staff by explaining an assay or its interpretation?
8. Does the fellow communicate results of critical assays to clinicians and/or house staff in a timely manner?
9. Does the fellow keep abreast of new developments in MGP by habitual reading of scientific literature?
10. Does the fellow actively participate in meetings and conferences at institutional, local, and national levels?
11. Has the fellow demonstrated growth in understanding of molecular principles and assumed a greater role of responsibility of tasks in the laboratory?

Systems-Based Practice

Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to call on system resources to provide molecular genetic pathology services that are of optimal value.

Description of Systems-Based Practice in MGP

MGP fellows must demonstrate the ability to provide guidance to clinicians and counselors to ensure that molecular testing is used and integrated into patient care in an appropriate and cost-efficient manner. Therefore, the fellow should demonstrate an understanding not only of how molecular testing can directly impact patient management but also how the fellow's actions and those of the molecular laboratory can affect other health care professionals, the health care organization, and the larger society. For genetic testing, the fellow must understand the importance of reviewing the family pedigree, patient history, and clinical indications to provide optimal care. For oncology testing, fellows should be able to recommend appropriate molecular testing in the context of the clinical questions and with consideration for the integration of additional or alternative testing modalities such as cytogenetics, fluorescence *in situ* hybridization, and immunophenotyping using flow cytometry and immunohistochemistry. Correlations of clinical diagnosis and clinical course with ancillary laboratory testing and molecular testing are crucial. Equally important is a comprehension of the scientific, legal (including ramifications of gene patents and other intellectual property claims), and ethical issues involved in molecular genetic testing as it pertains to the patient and society as a whole.

The fellow must be aware of and sensitive to the effect that laboratory turnaround times can have for clinicians and patients who may be anxiously awaiting test results. On the other hand, the fellow must also appreciate that

requests for special testing or rushed samples can place demands on laboratory staff and may increase costs to the institution. By being familiar with laboratory workflow, the fellow can play a role in facilitating effective and efficient practices.

Fellows should know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources. They must be familiar with the financial and organizational structure of the health care system to understand the forces that affect budgets and decisions that may influence what testing can be developed by the laboratory. Familiarity with laboratory billing methods, the use of current procedural terminology codes, diagnostic codes, and reimbursement and health insurance issues is also important.

In the era of finite health care dollars, inappropriate utilization of laboratory services should be discouraged by review of test requests and by education of the clinicians. Cost-effective health care and resource allocation that does not compromise quality of care must be practiced. Knowledge of available resources can be used to help coordinate and direct requests for molecular testing. For example, to prevent inefficient use of available financial resources, requests for testing that must be sent to laboratories outside the institution could be reviewed by the fellow for appropriateness. Furthermore, to help with such decisions, the fellow should be familiar with the latest literature, methods, and clinical research in molecular diagnostics and medical/human genetics.

Although direct contact between MGP fellows and patients is limited, there are many ways in which a fellow can be an advocate for quality patient care. In the laboratory setting, this can mean ensuring that test results and interpretations are of the highest possible quality as well as actively participating in QC and QA activities. In addition, fellows must advocate for the patient and assist clinicians in dealing with system complexities by providing guidance in the interpretation of test results and recommending additional testing when indicated.

Finally, the fellow must be able to partner with health care managers and health care providers to assess, coordinate, and improve health care and recognize the impact of these activities on system performance. The fellow must understand the general requirements of the Clinical Laboratory Improvement Amendments of 1988, the significance for clinical laboratory testing, and the mechanisms for Clinical Laboratory Improvement Amendments of 1988 laboratory certification. In particular, fellows should know how to meet the accreditation requirements of the College of American Pathologists, the Joint Commission, and other agencies. The fellow should demonstrate recognition of the need for continuous self-evaluation and improvement in the laboratory by contributing to quality improvement projects.

Summary of Goals

- Provide guidance to clinicians and counselors to ensure that molecular testing is used and integrated into patient care in an appropriate and cost-efficient manner.

- Demonstrate knowledge of scientific, legal, and ethical issues relating to molecular testing.
- Demonstrate knowledge of the impact of laboratory management and activities on other health care professionals, organizations, and society.
- Understand financial and economic systems in which the molecular laboratory operates, including billing, the use of current procedural terminology codes, diagnostic codes, and health insurance and reimbursement issues.
- Practice cost-effective health care and resource allocation that does not compromise quality of care.
- Be an advocate for quality patient care and contribute to clinician education.
- Demonstrate the ability to assess, understand, and use the resources, personnel, and health care systems necessary to provide optimal care.

Tools for Assessing Systems-Based Practice

360° Evaluation Instrument

Faculty and laboratory and administrative staff who interact with the fellow in the laboratory and on external rotations should evaluate the fellow with additional written documentation of specific observations that demonstrate the fellow's abilities, activities, or the application of knowledge of systems-based practice. Input from clinicians and other medical personnel outside of the laboratory or from other trainees may be beneficial to this process.

Checklist Evaluation

The checklist evaluation is designed to gather yes or no answers to specific behaviors or activities related to aspects of systems-based practice.

Portfolio

A log of cases or activities that provide evidence of learning and achievements should be maintained by the fellow. Notes can be included about recommendations to clinicians that provide evidence of cost-effective practices. Additional documents should capture involvement in quality assurance and quality improvement activities.

Sample Evaluation Questions for Assessing Systems-Based Practice Competency

1. Does the fellow correlate the results of molecular testing with other pertinent laboratory results and clinical information?
2. Is the fellow familiar with the scientific, legal, and ethical issues involved in molecular genetic testing, including informed consent?
3. Does the fellow help to facilitate effective and efficient laboratory workflow practices?
4. Is the fellow familiar with laboratory billing methods, the use of current procedural terminology codes,

diagnostic codes, and health insurance and reimbursement issues?

5. Is the fellow able to recommend cost-effective molecular testing or alternative testing that does not compromise patient care?
6. Does the fellow review the appropriateness of requests for molecular testing referred outside the institution?
7. Does the fellow assist clinicians by providing guidance in the interpretation of test results and recommending additional testing when necessary?
8. Is the fellow involved in the direct education of other physicians and health care providers through presentations at conferences and other venues?
9. Has the fellow participated in programs of QC, QA, and quality improvement?
10. Does the fellow understand the Quality Systems approach to laboratory practice?
11. Does the fellow understand the importance of Clinical Laboratory Improvement Amendments of 1988 and mechanisms for laboratory accreditation, including proficiency testing and inspection?

Discussion

The ACGME Outcomes Project has directed the flow of resident training along a new path, which stresses the arrival at a destination, ie, a competently trained physician. Initial efforts in Phase I began by introducing the competencies. Phase II of the ACGME Outcomes Project charged individual residency training programs with the task of developing learning opportunities and assessment tools in the six competencies. In addition, overall resident performance data were to be assessed by each training institution. Although the time frame set by ACGME for completion of Phase II was June 2006, the task of developing learning objectives appropriate for the desired outcomes and assessing resident performance is never complete but rather progressively evolves and improves with the educational experience and process. This is particularly pertinent to MGP training, which is a relatively new specialty operating within a rapidly changing technological arena. Therefore, the purpose of this document is to provide additional material for directors of existing MGP programs to consider for improvement of program objectives and enhancement of evaluation tools already in place. The guidelines should also provide a valuable framework for the development of new MGP programs. Nonetheless, we recognize that the structure of the educational experience offered by individual MGP programs will influence how these guidelines are ultimately implemented into the assessment of the competency of the MGP fellow. Despite such inevitable differences in the educational experience between MGP programs, evaluation of the goals for each of the competency areas as presented in this document should be

assessable within the context of any accredited MGP program.

Some of the MGP fellow competency assessment guidelines presented herein may also help in structuring training for pathology residents who are increasingly exposed to MGP techniques. There are also other publications on development of competency-based curricula and residency evaluation that may be suitable resources when designing an MGP program. A prior publication by the AMP Training and Education Committee presented guidelines for MGP training and expected competencies for pathology residents.⁴ Other guidelines and commentaries on competency-based curricula and evaluation have been published relating to training in anatomical pathology⁵ and clinical pathology.^{6–12}

For Phase III, each MGP program will need to develop a systematic method for measuring outcomes of individual fellows and of the educational process at the program and institutional levels. In conjunction with measuring outcomes, a process must be developed to implement programmatic improvements based on these measures. Ultimately, in Phase IV, due to begin in July 2011, programs will be challenged with identifying and adopting benchmarks and best practices aimed at establishing excellence in medical education. Our trainees in MGP deserve no less.

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