HEMATOPATHOLOGY FELLOW RESPONSIBILITIES

The specific fellowship rotations are described below. Fellows also have time to pursue their research projects that may be with faculty in the Division of Hematopathology, elsewhere in the Department of Pathology or in the School of Medicine. After their first two months, fellows also participate in the on-call schedule (with faculty supervision and back-up). Fellows are also active participants in the varied teaching activities of the Division and are expected to be an important resource for residents and faculty in the Department of Pathology, as well as for clinical fellows and faculty.

SPECIFIC ROTATIONS

<table>
<thead>
<tr>
<th>Hematopathology Fellowship</th>
<th>Adult Bone Marrow Rotation</th>
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<tbody>
<tr>
<td><strong>Description of Rotation or Educational Experience</strong></td>
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<tr>
<td>Adult bone marrow sign-out at the UPMC involves assembling the relevant smear and histologic slides and ancillary data, an initial review including the performance of a peripheral blood and marrow differential by the fellow and bone marrow technologist, where appropriate, and then a final sign-out with a staff hematopathologist. A preliminary review of marrow smears is also performed upon their receipt as well as review of pertinent slides/reports from prior marrow evaluations. Diagnoses include an interpretation of all ancillary data such as any cytochemical stains or flow cytometric immunophenotypic studies. For new diagnoses of malignant disorders, the synoptic part of the reports needs to be completed. Interpretations of studies that have a longer turnaround time such as cytogenetic or molecular studies are expected to be included in addenda to the original report. Initially the fellow reviews cases and then signs them out with a staff hematopathologist while later, with permission of the staff, they are given increasing responsibilities (all slides are ultimately reviewed by a hematopathologist). Competencies in signing out marrows and associated immunophenotypic, cytogenetic and genotypic studies are one of the areas stressed in this fellowship. The fellow is expected to help educate other trainees when present. The fellow is also expected to be available to review peripheral blood and marrow aspirate smears and marrow biopsies with students, trainees and staff from other departments.</td>
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</table>

**Patient Care**

**Goal**

Fellows must be able to provide diagnostic peripheral blood and bone marrow interpretations that are appropriate to enable the effective treatment of health problems and the promotion of health. Fellows are expected to:

**Competencies**

- Demonstrate an ability to sign out peripheral blood, marrow aspirate and biopsy evaluations utilizing morphology and ancillary studies and recognize neoplastic and non-neoplastic disorders that may involve the peripheral blood and bone marrow.

**Objectives**

- Write concise diagnostic reports that include an accurate diagnostic interpretation and description, that are easily understood, as independently as current regulations allow.
- Be able to integrate cytogenetic, molecular, immunohistochemical, cytochemical, and immunophenotypic data in diagnostic reports.
- Write accurate and concise interpretive flow cytometry interpretations based on review of the raw data, interacting with the laboratory when appropriate.
- Learn the use of a multiparameter approach to diagnostic peripheral blood and bone marrow pathology (morphology, flow cytometric and immunohistochemical phenotypic studies, cytogenetic studies, molecular studies and clinical data).
- Learn how to make cost-effective test utilization decisions regarding state-of-the-art peripheral blood and bone marrow evaluations.

**Medical Knowledge**

**Goal**
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological sciences, as well as the application of this knowledge to patient care.

**Competencies**
- Know normal and abnormal blood and bone marrow cell morphology.
- Ability to perform full bone marrow/peripheral blood differential counts.
- Develop a basic understanding of the diagnostic criteria for hematologic and non-hematologic disorders that may demonstrate bone marrow findings.
- Know the major clinical aspects of the disorders diagnosed by hematopathologists where bone marrow evaluation plays a significant role.

**Objectives**
- Complete checklist that includes acquisition of general knowledge related to hematopoietic disorders and bone marrow pathology as well as more specific knowledge about a list of important bone marrow neoplasms and non-neoplastic bone marrow related diagnoses.
- Write coherent diagnostic bone marrow and corresponding flow cytometry reports that indicate the ability to recognize the neoplastic hematopoietic/lymphoid disorders listed in the WHO classification and the non-neoplastic hematopoietic/lymphoid disorders that are expressed in the bone marrow.
- Obtain a score of competent on the objective test administered by the hematopathology division.
- Achieve a score above the 25th percentile on at least the spring examination of the Hematopathology Fellows In-Service Examination administered by the American Society of Clinical Pathologists (ASCP).
- See also general description.

**Practice-Based Learning and Improvement**

**Goal**
See general description.

**Systems Based Practice**

**Goal**
See general description.
| Professionalism  
| Goal  
| See general description.  
|  
| Interpersonal and Communication Skills  
| Goal  
| See general description  
|  
| Teaching Methods  
|  
| • Direct sign-out at a multiheaded microscope with the primary attending hematopathologist, with one-on-one didactic and Socratic interaction.  
| • Use of actual and virtual teaching sets of glass slides and case studies including:  
|   o Hematopathology Virtual Slide Study Set (folder with case list can be checked out from the hematopathology secretaries [G306] and a spreadsheet with a link to the cases is located in the resident’s drive.  
| • Reading of various textbooks and original literature available within the hematopathology division.  
| • See also general description.  
|  
| Assessment Method (fellows)  
|  
| • Monthly Milestone electronic evaluations by attending faculty (based on direct supervision and observation).  
| • Multisource (360-degree) evaluation process.  
| • ASCP CheckPath Examination (quarterly).  
| • Direct, objective written examination administered by division (twice/year).  
| • Biannual review by fellowship program director or designee.  
| • ASCP Fellow In-Service Examination (twice/year).  
| • Review of rotation checklist with fellowship director or his designate: [Checklist Bone Marrow Rotation](#).  
| • Review of case log numbers with fellowship director or designee.  
|  
| Assessment Method (Program Evaluation)  
| See general description.  
|  
| Level of Supervision  
| One of the hematopathology attendings is assigned to cover the service (generally on a weekly basis). Fellows report directly to that faculty member. In addition, if there is an insufficient bone marrow case load on the service to which the fellow is assigned (as determined by the supervising attending pathologist), then fellows are asked to identify additional cases to sign out with the faculty on the other adult marrow services.  
|  
| Bone Marrow After Hours Procedure  
| Educational Resources  
|  
| • A teaching set of cytochemical stains and peripheral blood and bone marrow smears is available from the bone marrow technologists. Individual faculty members also have teaching slides.
Hematopathology Virtual Slide Study Set (folder with case list can be checked out from the hematopathology secretaries [G306] and a spreadsheet with a link to the cases is located in the resident’s drive).

“Articles for Residents” black binders. Classic reference articles for classification of leukemia, etc. Located in G323.


Hematology laboratory procedures may be viewed at: http://www.medialabinc.net/ Click on Users under Subscriber Login (to right of page). (See division coordinator for specific usernames and passwords)

- First, under “Viewing”, select “PUH CP”.
- Select “View Documents & Manuals” Tab
- Choose Manuals under left hand menus for “View Documents & Manuals”
- Then choose appropriate manual
  “Automated Testing Laboratory” for Hematology manual or Special Hematology” for bone marrow, lymph node, and flow cytometry related manuals and procedures.

<table>
<thead>
<tr>
<th>Hematopathology Fellowship</th>
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<tr>
<td>Adult Clinical Bone Marrow Procedures and Hematology/Oncology Clinical Experience</td>
</tr>
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</table>

**Description of Rotation or Educational Experience**

Although the collection of bone marrow samples are frequently performed by hematologists-oncologists and other non-pathologist physicians or support staff, a hematopathologist must
know how to perform a bone marrow biopsy and aspirate collection and may need to do so in a future practice setting. Hematopathology Fellows at UPMC are expected to perform at least ten marrow aspirate and biopsy collections in the hematology/bone marrow transplant division or to have performed them previously. In order to help accomplish this, to better learn and to appreciate the clinical aspects of the disorders we diagnose and also to learn about what the clinician expects from hematopathologists, fellows are expected to spend at least 2 and one-half days rotating with members of the hematology/oncology division. Most of this experience will be obtained at the Hillman Cancer Center. Working with the OHA physician’s assistant is recommended. Additional time at Hillman may be arranged on an individual basis, if additional time is needed to complete the minimum 10 marrow procedures required. Also see the Hematology/Oncology Clinical Experience schedule for more information.

**Patient Care**

**Goal**

Fellows must be able to perform bone marrow biopsy and aspirate collections that provide adequate aspirate and biopsy material for diagnosis, with concern also for patient safety and comfort.

**Competencies**

- Demonstrate an ability to perform successful bone marrow aspirate and biopsy collections that produce satisfactory specimens, with appropriate concern for patient comfort and safety.
- Demonstrate ability to interact with both patients and other treating physicians.

**Objectives**

- Fellows will perform at least 10 marrow collection procedures on living patients in the adult bone marrow hematology-oncology clinic at UPMC-Shadyside/Hillman Cancer Center under the guidance of the hematology-oncology faculty, hematology-oncology fellows, or hematology-oncology physician assistants that are skilled in performing these procedures or have documentation of prior satisfactory competence from residency or other training.
- Know the type of information clinical hematologist/oncologists require from hematopathologists.
- Fellows should be able to obtain consent from patients for a bone marrow procedure, explaining the procedure in appropriate terms that he/she can understand, while not causing undue anxiety or alarm.

**Medical Knowledge**

**Goal**

Fellows must demonstrate knowledge of the bone marrow collection procedure and know the hematopathology findings for the disorders seen in clinic.

**Competencies**

- Learn the types of needles and equipment required to perform a marrow collection.
- Be familiar with the clinical aspects of the hematologic disorders encountered.

**Objectives**
• Fellows must have a formal evaluation sheet completed, listing each marrow collection by the appropriate supervising physician or staff, as documentation that they have a practical working knowledge of how to perform a successful bone marrow procedure. This form also documents the observer’s assessment of the fellow’s interaction with the patient, as well as the adequacy of the sample collected (usually as assessed by the assigned hematopathologist signing out the case).
• Fellows should also be able to provide information related to hematopathology issues to the clinician(s) for patients encountered on this brief rotation.

**Practice-Based Learning and Improvement**

**Goal**
Fellows must demonstrate the flexibility to alter their procedure as needed if review of the final bone marrow sections and aspirate smears indicates an inadequate sample collection or if unnecessary patient discomfort occurs.

**Competencies**
• Provide self-assessment and positive response to criticism with regard to performing bone marrow collection procedures.
• Learn how to determine if they have obtained a specimen that is satisfactory for diagnosis.

**Objectives**
• Each marrow collection should be reviewed with appropriate hematopathology faculty who can assess whether the sample is adequate for diagnosis.
• Additionally, staff and faculty in hematology-oncology will provide feedback on-site related to issues regarding the fellow’s concern for patient comfort, safety, and general well-being, or if they suspect the collection was inadequate or likely suboptimal.

**Systems Based Practice**

**Goal**
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively upon other resources in the system to provide optimal health care.

**Competencies**
• Fellows should develop an awareness of the physical and staffing resources that may be needed to provide a marrow collection service, especially in future practice.

**Objectives**
• Observe the staff and faculty who perform marrows with discussion, as appropriate.

**Professionalism**

**Goal**
Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.

**Competencies**
- Fellows should demonstrate compassion, integrity, and respect for others.
- Fellows should demonstrate respect for patient privacy and autonomy.

**Objectives**
- Demonstrate appropriate concern for the patient’s well-being during the marrow collection procedure, which will be assessed by the supervising physician or staff.
- Demonstrate compliance with HIPAA privacy requirements.
- Show respect for the patient’s right to refuse a marrow collection or request that another person perform the collection.

**Interpersonal and Communication Skills**
Fellows must demonstrate an ability to communicate effectively with patients directly. This may include explaining the reasons for obtaining a marrow sample, what will be assessed, and conveying the risks and benefits of the marrow collection. He/she may also need to allay any fears or anxiety a patient may have about the marrow procedure and explain to the patient how he/she will be informed of the results.

**Competencies**
- Fellows must demonstrate flexibility in their interactions with patients and be prepared to explain some of the risks and benefits of the procedure in language that the patient can understand.
- Fellows must also be able to assess the patient’s comfort and concern during the procedure.

**Objectives**
- Fellows must be prepared to obtain consent if needed.
- Fellows should assess patient level of comfort through observation and direct verbal communication with patient.

**Teaching Methods**
- Direct supervision.
- Reading textbook materials indicated below.
- See also general description.

**Assessment Method (fellows)**
- Direct observation by supervising personnel.
- Evaluation of the marrow samples by hematopathology faculty.
- Written assessment of each collection procedure by having supervising staff complete the requisite evaluation form. [Bone Marrow Aspirate Biopsy Form](#)

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Fellows report to staff and faculty within the hematology-oncology bone marrow outpatient clinic at UPMC-Shadyside/Hillman Cancer Center, who directly supervise the fellow both in...
seeing clinical patients and when performing bone marrow collection procedures. Marrow sample evaluations are performed by the attending hematopathologist to whom the marrow case is assigned.

### Educational Resources

- Staff and faculty within hematology-oncology.

### Hematopathology Fellowship

#### Lymph Node Pathology (and related solid tissue hematopathology)

#### Description of Rotation or Educational Experience

The hematopathology division is responsible for the gross processing and final sign-out of most diagnostic lymph node biopsies (and related solid tissue hematopathology). Fellows are responsible for handling and triaging the gross specimen either directly, or more often indirectly by providing assistance as needed and oversight of “lymph node” technologists. They then review all histologic material and gather the ancillary data such as the flow cytometric immunophenotypic data. Depending on the experience of the fellow, they may at this point order additional ancillary studies such as immunohistochemical stains. As they progress, they are also expected to dictate cases in advance of their sign-out. After interpreting everything, the case including the ancillary studies will be signed out with the faculty hematopathologist. Addenda will be issued for ancillary studies such as genotypic studies completed after the case has been signed out. This part of the fellowship will include review of any solid tissue hematopathology consults or any consults specifically sent to the faculty on this service. This functional approach to diagnostic lymph node pathology is an area, which is stressed in the fellowship. In addition, fellows are encouraged to review any fluorescence in situ hybridization testing performed on lymph nodes or other solid tissues, which are signed out in the Division of Hematopathology. Fellows also play a role in the education of residents, clinical fellows and hematologists/oncologists.

#### Patient Care

**Goal**

Fellows must be able to provide diagnostic lymph node interpretations that are appropriate to enable the effective treatment and the promotion of health. Fellows are expected to:

**Competencies**

- Demonstrate an ability to sign out lymph nodes and other related biopsy evaluations utilizing morphology and ancillary studies.
- Recognize the majority of neoplastic and non-neoplastic disorders that may involve tissues.
- Develop familiarity with the interpretation of fluorescence in situ hybridization studies performed on lymph nodes or other solid tissues.
Objectives

- Write concise diagnostic reports that include an accurate diagnostic interpretation and description, that are easily understood, as independently as current regulations allow.
- Be able to integrate cytogenetic, molecular, and immunophenotypic data in diagnostic reports.
- Write accurate and concise flow cytometry interpretations based on review of the raw data interacting with the laboratory when appropriate.
- Review and actively participate in the interpretation of fluorescence in situ hybridization studies performed on lymph nodes or other solid tissues and signed out in the Division of Hematopathology.
- Learn the use of a multiparameter approach to diagnostic lymph node pathology (morphology, flow cytometric and immunohistologic phenotypic studies, genotypic studies, cytogenetic studies and clinical data).
- Learn to diagnose reactive lymphadenopathies, Hodgkin lymphomas, the non-Hodgkin lymphomas and other hematopathologic disorders seen in tissue biopsies.
- Learn how to make cost-effective test utilization decisions regarding state-of-the-art lymph node and related tissue evaluations.

Medical Knowledge

Goal
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological features of hematolymphoid disorders involving lymph nodes and related tissues, as well as knowing how to apply this knowledge to patient care.

Competencies

- Know normal and abnormal lymphoid and related tissue morphology.
- Have a basic understanding of the diagnostic criteria for hematopoietic/lymphoid disorders that may involve or primarily involve tissues.
- Know the major clinical aspects of disorders diagnosed by hematopathologists using lymph nodes and related tissue biopsies.

Objectives

- Complete checklist that includes acquisition of general knowledge related to lymph node and related tissue pathology.
- Understand the pathobiology of the disorders that involve lymph nodes and related tissues.
- Write coherent diagnostic lymph node and corresponding flow cytometry reports that indicate the ability to recognize the neoplastic hematopoietic/lymphoid disorders listed in the most recent WHO classification and the non-neoplastic hematopoietic/lymphoid disorders that are expressed in extramedullary tissues.
- Obtain a score of competent on the objective test administered by the hematopathology division.
- Achieve a score above the 25th percentile on at least the spring examination of the Hematopathology Fellows In-Service Examination administered by the American Society of Clinical Pathologists (ASCP).
- See also general description.
<table>
<thead>
<tr>
<th>Practice-Based Learning and Improvement</th>
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<td>See general description.</td>
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<th>Systems Based Practice</th>
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<td>See general description.</td>
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<th>Professionalism</th>
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<td>See general description.</td>
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<tr>
<th>Interpersonal and Communication Skills</th>
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<td>See general description.</td>
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<tr>
<th>Teaching Methods</th>
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<td>• Direct sign-out at a multiheaded microscope with the primary attending hematopathologist, with one-on-one didactic and Socratic interaction.</td>
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<td>• Use of actual and virtual teaching sets of glass slides and case studies including:</td>
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<td>o Hematopathology Virtual Slide Study Set (folder with case list can be checked out from the hematopathology secretaries [G306] and a spreadsheet with a link to the cases is located in the resident’s drive).</td>
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<td>• Reading of various textbooks and original literature available within the hematopathology division.</td>
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<tr>
<td>• See also general description.</td>
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<th>Assessment Method (fellows)</th>
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<tr>
<td>• Multisource (360-degree) evaluation process.</td>
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<td>• Review of lymph node rotation checklist with fellowship director or designee.</td>
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<tr>
<td>• Review of case log numbers with fellowship director or designee.</td>
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<tr>
<td>• ASCP Check Path examination (quarterly).</td>
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<td>• Direct, objective written examination administered by division (twice/year).</td>
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<td>• Biannual review by fellowship program director or designee.</td>
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<tr>
<td>• ASCP Fellow In-Service Examination (twice/year).</td>
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<th>Assessment Method (Program Evaluation)</th>
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<td>See general description.</td>
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<tr>
<th>Level of Supervision</th>
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<tr>
<td>One or two of the hematopathology attendings is assigned to cover the service (generally on a weekly basis). Fellows report directly to these faculty members, who are ultimately responsible for the quality of all decisions made and for the reports signed out.</td>
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<tr>
<th>Educational Resources</th>
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<tbody>
<tr>
<td>• Lymph node chapter in Sternberg. [Highly recommended]</td>
</tr>
<tr>
<td>• Swerdlow, S.H., Campo, E., Harris, N.L., Jaffe, E., Pileri, S.A., Stein, H., Thiele, J.,</td>
</tr>
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</table>
Hematopathology Fellowship

Flow Cytometry

**Description of Rotation or Educational Experience**

While most of the interpretive teaching and indications for flow cytometric immunophenotypic testing will occur during marrow and lymph node sign out, one week will be spent in the laboratory learning some of the technical aspects involved in these studies. In addition, during the pediatric hematology/laboratory hematology rotation, fellows will review the following flow cytometry tests with the hematopathologist responsible for flow onlies sign-out: paroxysmal nocturnal hemoglobinuria (PNH) and neutrophil oxidative burst assay (NOBA). Fellows are also encouraged to review flow cytometric studies performed on fluids during the pediatric hematology/laboratory hematology rotation.

**Patient Care Goal**

Fellows must be able to provide diagnostic flow cytometry interpretations that are appropriate to enable the effective treatment of health problems and the promotion of health. In order to provide accurate interpretations, fellows must have an understanding of the technical aspects of
flow cytometric testing, including compensation, quality control, quality assurance, and evaluation of new antibodies or staining methods.

**Competencies**
- Demonstrate an ability to interpret flow cytometry evaluations and recognize the majority of neoplastic and non-neoplastic disorders that may involve bone marrow, tissue samples, blood samples and body fluid samples. (This is an expectation that extends throughout fellowship, as the fellow will interpret and write-up marrow and tissue flow cytometric studies while rotating on the bone marrow and lymph node services.)
- Demonstrate an understanding of the diagnostic limitations of flow cytometry when evaluated in the absence of other diagnostic data such as tissue morphology, bone marrow aspirate smear morphology, or appropriately made blood smear or fluid cytologic preparations.
- Demonstrate an understanding of some of the testing that may be specific to the flow cytometry laboratory and how these tests are used in patient care (i.e. PNH testing, NOBA testing, lymphocyte subset testing).
- Understand how flow cytometry can be used to assess minimal residual disease.

**Objectives**
- Understand sample preparation, basic flow cytometry, quality control, gating on specific cell populations, determination of positive versus negative staining and methods of data presentation.
- Know indications for testing, taking into account cost effective medicine.
- Become familiar with the preparation of specimens.
- Know how specialized assays such as immunodeficiency related testing (NOBA, CD4 counts) are performed and reported.
- Become familiar with in-house and Children’s Oncology Group (COG) minimal residual disease assays.
- Know the clinical significance of the specialized assays mentioned above.
- Develop an understanding of how analytic software is used to aid in interpretation, with review of gating concepts/strategies vs. cluster analysis and other applicable methods.

**Medical Knowledge**

<table>
<thead>
<tr>
<th>Goal</th>
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<tr>
<td>Fellows must demonstrate knowledge of the technical aspects and specific testing issues unique to the flow cytometry laboratory and how these influence diagnostic decision making.</td>
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<th>Competencies</th>
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<tr>
<td>Acquire a working technical knowledge of how samples are stained, how flow cytometers work, and methods of data analysis, with emphasis on the specific testing performed in the UPMC hematopathology division laboratory.</td>
</tr>
<tr>
<td>Learn normal and abnormal flow cytometry findings in the various tissues and body fluids studies. (Much of this interpretive knowledge will be gained as part of the lymph node and bone marrow rotations.)</td>
</tr>
<tr>
<td>Learn the expected flow cytometry findings in the immunophenotyping of disorders</td>
</tr>
</tbody>
</table>
Objectives

- Complete checklist that includes acquisition of general knowledge related to hematopoietic disorders of the bone marrow, blood, and lymph node tissues, as well as more specific knowledge.
- Obtain a score of competent on the objective test administered by the hematopathology division.
- Obtain at least a score above the 25th percentile on the Hematopathology Fellows In-Service Examination on the spring testing administered by the American Society of Clinical Pathologists (ASCP).
- Review the aspects of the testing unique to flow cytometry (NOBA assay, PNH, minimal residual disease testing) through either direct laboratory observation or independent reading of laboratory procedure manuals or appropriate textbooks available within the hematopathology division or flow cytometry laboratory.

Practice-Based Learning and Improvement

Goal
See general description.

Systems Based Practice

Goal
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

Competencies

- Incorporate considerations of cost awareness and risk-benefit analysis in ordering flow cytometric testing.
- Demonstrate an awareness of regulatory requirements as relevant to hematopathology and to flow cytometry specifically, including those required by the College of American Pathologists and, if applicable, local or state regulations.

Objectives

- Become familiar with the technical resources used in the operation of a flow cytometry laboratory.
- Demonstrate ability to choose appropriate flow cytometry panels for making a specific diagnosis or for most effectively evaluating a particular sample.
- Participate in mock College of American Pathologists laboratory inspection, if timing of inspection coincides with fellowship, or preparation for real or mock CAP inspection.
- May participate in faculty-supervised quality improvement projects that are relevant to flow cytometry evaluation or utilization of this testing.

Professionalism

Goal
See general description.
### Interpersonal and Communication Skills
See general description.

### Teaching Methods
- Use of teaching sets and case studies (see “FlowLab Teaching” folder in J drive).
- Reading of various textbooks and original literature available within the hematopathology division.
- Direct observation of technical staff.
- See also general description.

### Assessment Method (fellows)
- Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
- Multisource (360-degree) evaluation process.
- Review of checklist with flow cytometry laboratory director or designee: [Checklist Flow Cytometry Rotation](#).
- Direct, objective written examination administered by division (twice/year).
- ASCP Fellowship In-Service Examination (FISHE).
- ASCP Check Path examination (quarterly).
- Review of case log numbers with fellowship director or designee.
- Biannual review by fellowship program director or designee.

### Assessment Method (Program Evaluation)
See general description.

### Level of Supervision
Fellows report directly to the medical director of the flow cytometry lab or appropriate designee.

### Educational Resources
Description of Rotation or Educational Experience

The object of this rotation is for fellows to become familiar with pediatric hematopathology: interpretation of bone marrow aspirates, biopsies, peripheral blood smears, and body fluids. The fellow learns how to interpret results by integrating the information obtained by these methods together with flow cytometric results, molecular findings, immunohistochemistry studies, cytogenetics and clinical hematology tests. Pediatric lymph node biopsies that have flow cytometric immunophenotyping studies are reviewed as well as part of the Lymph Node Pathology rotation. Fellows will become familiar with the evaluation of hemoglobinopathies, including interpretation of HPLC (high performance/high pressure liquid chromatography) results at Children's Hospital of Pittsburgh. Fellows also participate either with a faculty member or independently in the Children's Hospital of Pittsburgh Leukemia Tumor Board and in the Pediatric Hematology/Oncology fellows’ microscopic slide review conferences, which is performed in person at Children's Hospital of Pittsburgh or via web-based conferencing (for displaying images and other relevant information on guest computers within the UPMC network) and a conference call set-up or speaker phone, depending on the number and location of conference participants. In addition, fellows will participate in laboratory operations and management meetings as scheduled during the rotation.

Patient Care

Goal

Fellows must be able to provide diagnostic marrow interpretations on samples from pediatric patients and accurately evaluate other pediatric samples related to hematopathology that are appropriate to enable the effective treatment of health problems and the promotion of health. In addition, fellows should also be aware of some of the privacy and consent issues that may be unique to pediatric patient settings.

Competencies

- Demonstrate an ability to sign out marrow aspirate and biopsy evaluations utilizing morphology and ancillary studies and recognize the majority of neoplastic and non-neoplastic disorders that may involve bone marrow and blood.
- Provide accurate and clinically useful interpretations of pediatric peripheral blood smears, body fluid specimens, and HPLC results seen in the Division of Hematopathology.

Objectives

- Write concise diagnostic reports that include an accurate diagnostic interpretation and description, that are easily understood, as independently as current regulations allow.
- Be able to integrate cytogenetic, molecular, immunohistochemical, cytochemical, and immunophenotypic data in diagnostic reports.
- Write accurate and concise flow cytometry interpretations based on review of the raw data, interacting with the laboratory when appropriate.
- Write accurate comments (for entry into the laboratory information system) that reflect cells or abnormalities identified on blood smear and body fluid review. This may also involve accurately instructing the technologists at Children's Hospital of Pittsburgh with
regard to up-dating the differential counts and cell designations.

**Medical Knowledge**

**Goal**
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological information, as well as the application of this knowledge to patient care. This requires an understanding of the unique aspects of pediatric hematopathology.

**Competencies**
- Learn normal and abnormal blood cell morphology.
- Learn the diagnostic aspects of the hematologic diseases that may be found primarily or exclusively in pediatric and adolescent patients.
- Develop a basic understanding of the diagnostic criteria for the hereditary hematologic diseases that are usually or often first diagnosed in children, such as hemoglobinopathies.
- Learn the interpretation of HPLC results for the detection of aberrant and normal hemoglobins.
- Learn the major clinical aspects of pediatric disorders diagnosed by hematopathologists.

**Objectives**
- Complete checklist that includes acquisition of general knowledge related to hematopoietic disorders and bone marrow pathology as well as more specific knowledge about a list of important bone marrow neoplasms and bone marrow related diagnoses.
- Write coherent diagnostic bone marrow and corresponding flow cytometry reports that indicate the ability to recognize the neoplastic hematopoietic/lymphoid disorders listed in the 2016 WHO classification and the non-neoplastic hematopoietic/lymphoid disorders that are expressed in the bone marrow.

**Practice-Based Learning and Improvement**
See general description.

**Systems Based Practice**
See general description.

**Professionalism**
See general description.

**Interpersonal and Communication Skills**
See general description.

**Teaching Methods**
- Direct sign-out at a multiheaded microscope with the primary attending pathologist, with one-on-one didactic and Socratic interaction.
- Use of actual and virtual teaching sets of glass slides and case studies including:
  - Peripheral Blood and Fluid Slide Study Set that can be checked out from the
hematopathology secretaries (G306) (the directory of cases is in the resident’s drive).
  o Hematopathology Virtual Slide Study Set (folder with case list can be checked out from the hematopathology secretaries [G306] and a spreadsheet with a link to the cases is located in the resident’s drive).
- Reading of various textbooks and original literature available within the hematopathology division.
- See also general description.

### Assessment Method (fellows)
- Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
- Multisource (360-degree) evaluation.
- ASCP CheckPath Examination (quarterly).
- Direct, objective written examination administered by division (twice/year).
- ASCP Fellow In-Service Examination (twice/year).
- Pediatric Rotation Checklist (reviewed by Fellowship Program Director or Designee): [Checklist Pediatric Hematopathology Rotation](#)
- Review of case log numbers with fellowship director or designee.
- Biannual review by fellowship program director or designee.

### Assessment Method (Program Evaluation)
See general description.

### Level of Supervision
One of the hematopathology attendings is assigned to cover the pediatric marrow service (generally on a weekly basis). Fellows report directly to that faculty member.

### Educational Resources
- Proytcheva, Maria A. *Diagnostic Pediatric Hematopathology*. Cambridge: Cambridge University Press; 2011
- Actual and virtual teaching sets of glass slides and case studies including:
  - Peripheral Blood and Fluid Slide Study Set that can be checked out from the hematopathology secretaries (G306) (the directory of cases is in the resident’s drive).
  - Hematopathology Virtual Slide Study Set (folder with case list can be checked out from the hematopathology secretaries [G306] and a spreadsheet with a link to the cases is located in the resident’s drive).

| Hematopathology Fellowship  
<table>
<thead>
<tr>
<th>Molecular &amp; Genomic Pathology</th>
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<tr>
<td><strong>Description of Rotation or Educational Experience</strong></td>
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<td>The molecular oncology rotation allows the fellow to become familiar with the basic molecular biologic techniques used to support hematopathology. The laboratory is responsible for a variety of studies including B-cell (IGH and IGK) and T-cell (TCRB and TCRG) clonality specific chromosomal translocations (<em>BCR-ABL1</em> and <em>PML-RARA</em>) assessment of <em>JAK2 V617F</em> and <em>CALR</em> mutations associated with some myeloproliferative neoplasms, <em>NPM1</em> and <em>FLT3</em> mutations associated with acute myeloid leukemia, and CytoScan microarray for genome-wide copy number assessment. The fellow will become familiar with the professional functions associated with sample analysis including physician responsibility for correlating clinical history with laboratory requests to ensure proper clinical testing, selection of tests to be performed, review of test progress, interpretation and communication of preliminary results, interpretation and reporting of final results in oral and written form. The fellow is expected to attend key Division conferences (primarily the Friday Hematologic Oncology [Hemeonc]/Genetics Consensus Conference and the Tuesday MGP Trainee Education Conference). Fellows should be aware that, it is expected that fellows will direct their efforts to the rotation during regular working hours and not take more than one week of their vacation during this rotation.</td>
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| **Patient Care**  
| **Goal** |
| Fellows must have a working understanding of how related oncologic molecular testing is used in either (a) making a specific primary diagnosis, (b) follow up of patients as testing for residual disease, or (c) as a supplemental or confirmatory diagnostic tool. They should also be able to participate in a molecular pathology service at the faculty level, since this is a role some hematopathologists perform in practice. |

| **Competencies**  
| - Demonstrate an understanding of how molecular testing is applied to the diagnosis and follow-up of hematologic diseases.  
<p>| - Be able to interpret molecular studies performed in the evaluation of hematopoietic/lymphoid disorders and write a diagnostic report. |</p>
<table>
<thead>
<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>• Acquire adequate knowledge about hematopathology molecular testing through didactic materials (such as lecture powerpoints) and text books available in the M&amp;GP Division (week 1).</td>
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<td>• Demonstrate progressive responsibility to compose draft final reports on at least one-half of relevant cases (weeks 2 through 4).</td>
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<td>• Present relevant molecular diagnostics laboratory data for the cases discussed in the weekly hematopathology interesting case conference.</td>
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<td>• Demonstrate an ability to directly interpret routine PCR, RT-PCR, sequencing, and microarray findings and be able to relate these results to the patient’s overall diagnosis.</td>
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<tr>
<th>Medical Knowledge</th>
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<tr>
<td><strong>Goal</strong></td>
<td>Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological aspects of hematopathology-related molecular diagnostic testing, as well as the application of this knowledge to patient care.</td>
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<tr>
<th>Competencies</th>
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<tr>
<td>• Understand the basic concepts of molecular biology.</td>
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<td>• Understand the testing methods used for specific hematopathology-related laboratory tests performed by the molecular diagnostics lab.</td>
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<tr>
<td>• Know the basic molecular basis for the major hematopoietic/lymphoid neoplasms.</td>
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<td>• Know what is considered to be state-of-the-art diagnostic molecular testing in hematopathology.</td>
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<tr>
<th>Objectives</th>
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<tr>
<td>• Review the basic concepts of molecular biology through appropriate reading of textbooks and primary literature.</td>
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<tr>
<td>• Sign out of hematopathology cases with molecular &amp; genomic pathology faculty.</td>
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<th>Practice-Based Learning and Improvement</th>
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<td><strong>Goal</strong></td>
<td>See general description.</td>
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<th>Systems Based Practice</th>
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<th>Professionalism</th>
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<th>Interpersonal and Communication Skills</th>
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<tr>
<th>Teaching Methods</th>
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<tr>
<td>• Direct sign-out with the primary attending pathologist, with one-to-one didactic and Socratic interaction.</td>
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</table>
• Reading of various textbooks and original literature available within the hematopathology or Molecular & Genomic Pathology (M&GP) division.
• See also general description.

Assessment Method (fellows)
• Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
• End of rotation meeting / final evaluation review with the M&GP designee.
• Final written evaluation of rotation performance by the M&GP designee.

Assessment Method (Program Evaluation)
• Molecular and Genomic Pathology Checklist: Molecular & Genomic Pathology Rotation Checklist
• See general description.

Level of Supervision
Direct observation and evaluation by attendings covering the molecular & genomic pathology lab service while the fellow is on rotation.

Educational Resources
1. Readings provided on site.
2. Primary literature available in the Division of Hematopathology, the Falk Health Sciences Library, or electronically.
3. Molecular hematopathology didactic materials available in the Division of M&GP.
4. Interesting case collection.

Hematopathology Fellowship
Cytogenetics

Description of Rotation or Educational Experience
This rotation allows the fellow to familiarize him or herself with the procedures carried out in the Cytogenetics laboratory, their application to clinical cases, and the roles of classical and molecular cytogenetics in clinical practice, specifically in hematopathology. The majority of the specimens studied will be bloods and marrows from patients with leukemia or myelodysplastic syndromes and diagnostic lymph node biopsies. It is also an opportunity to review the major cytogenetic abnormalities seen in specific types of hematopoietic/lymphoid disorders.

Patient Care
Goal
Fellows must have a working knowledge of basic cytogenetics testing methods and interpretation of results in order to be able to apply such testing to the diagnosis and clinical follow up of patients with hematopoietic and lymphoid neoplasms. Increasingly, this information is being incorporated into the diagnosis and classification of diseases defined within the World Health Organization (WHO) classification of hematopoietic and lymphoid tumors.
Competencies

- Learn the indications for cytogenetic testing relevant to hematopathology.
- Be able to interpret classical and fluorescence in situ hybridization (FISH) cytogenetic findings.
- Develop a familiarity with microarray methodologies in assessing chromosomal gains and losses.

Objectives

- Know indications for testing, taking into account cost effective medicine.
- Understand the rationale and methods of procedures and the basic safety precautions practiced in the laboratory, as described in the laboratory procedure manual.
- Learn the basic laboratory procedures: cell culture initiation, harvest, banding, chromosome analysis, karyotyping and FISH (metaphase and interphase).
- Practice karyotyping and basic write-ups of the results within a cytogenetics report.
- Learn the advantages and limitations of karyotyping and molecular cytogenetic methods. Recognize the sources for result discrepancy.
- Participate actively in the sign out of cases with the Laboratory Director and colleagues and keep a list of the cases. Fellows should review all current cases related to hematopathology and hematopathology-associated specimens (bone marrow and hematopathology tissue workups).
- Observe the use and understand the limitations of microarray methods.
- Attend one of the monthly microarray case review conferences, if possible.
- Participate in faculty-supervised quality improvement projects, if possible.

Medical Knowledge

Goal

Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological aspects of cytogenetics as they relate to hematopathology, as well as the application of this knowledge to patient care and the basic foundation of these studies.

Competencies

- Understand how the different types of cytogenetic tests are used in hematopathology, how they are performed, and how they are interpreted.
- Know the cytogenetic abnormalities in the major hematopathologic disorders and their clinical significance.

Objectives

- Review recent articles and text from the classical and molecular cytogenetics literature, to become familiar with the fields of genetics and cytogenetics, cytogenetic methods, and applications to clinical medicine, particularly with regard to hematopathology.
- Review the files of interesting cases to observe the longitudinal changes in karyotypes over the course of treatment and to see how various cytogenetic findings are interpreted.
- Complete checklist for the rotation.

Practice-Based Learning and Improvement

Goal
See general description.

**Systems Based Practice**
See general description.

**Professionalism**
See general description.

**Interpersonal and Communication Skills**
See general description.

**Teaching Methods**
- Direct sign-out with the service director or other designated faculty, with one-on-one didactic and Socratic interaction.
- Use of teaching sets and case reviews.
- Reading of various textbooks and original literature.
- See also general description.

**Assessment Method (fellows)**
- Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
- End of rotation meeting with the cytogenetics laboratory director or designee.
- Cytogenetics Rotation Checklist: Cytogenetics Rotation Checklist
- Cytogenetics Case Log: CYTOGENETICS CASE LOG

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Fellows interact directly with laboratory technologists and faculty in the cytogenetics laboratory.

**Educational Resources**
- Cytogenetics Laboratory Procedure Manual
- Cytogenetics Laboratory Oncology FISH Probe List (http://pittgenetics.com/PDFfiles/ONC%20PROBES.pdf).
Hematopathology Fellowship
Laboratory Hematology

Description of Rotation or Educational Experience

This rotation offers the fellow the opportunity not only to learn about automated and non-automated hematology testing, but also to learn about the role of the laborator in the diagnosis of hematological disorders and to learn the features of the types of disorders encountered, with emphasis on non-neoplastic hematopathology. The general hematology section of the automated testing laboratory performs complete blood counts (CBCs), routine coagulation studies, urinalysis and body fluid counts and smear evaluations on adult and pediatric patients from Children’s Hospital of UPMC. The fellow will become acquainted with the following principles and practice of automated laboratory hematology:

1. Coulter DxH800 and LH750: specific methods and features of these hematology analyzers are utilized to evaluate multiple blood parameters, daily set up, instrument troubleshooting, quality control (Q.C.) procedures and understanding of instrument flags. Fellow will observe operation of instrument.

2. Coagulation automated equipment [STA-R Evolution (Diagnostica Stago, Inc)]: morning set up, trouble shooting, Q.C. procedures and understanding of instrument flags. Fellow will observe operation of instrument.

3. Urinalysis equipment including Sysmex UF-1000: set-up and operation, QC/QA procedures, instrumentation principles of operation, instrument archive of abnormal crystals, casts, and cells within urine sediments.

4. Cellavision: Fellow will observe the performance of a peripheral blood and body fluid differentials with digital imaging.

The fellow will also have experience in the review of abnormal laboratory results, review of abnormal peripheral blood smears and body fluid cytocentrifuge preparations or smears, quality control, quality assurance and proficiency surveys.

The Special Hematology Laboratory performs cytochemical stains with the following tests sent to other UPMC or reference laboratories: hemoglobinopathy testing, red blood cell enzyme testing, osmotic fragility testing and autohemolysis. HPLC testing for hemoglobin variants is performed at Children’s Hospital of Pittsburgh. All tracings are faxed to the hematopathology division on a weekly basis and kept in a binder in sign-out room G315.
Fellows are expected to review and read about the results from the most recent 6-12 months during their rotation and, during the last half of the rotation, to meet and discuss interesting cases with the pathologist who signs out these cases while on rotation (currently Dr. Steven Dobrowolski at Children’s Hospital of Pittsburgh). All other results are returned to the special hematology laboratory for review by the hematopathologists. For both in-house and send-out special hematology tests, the fellow will review and understand the methodology for all procedures, participate in assay procedures performed at CLB, review and interpret the results, relate results to clinical data, review indications for testing, and how results should be used. The fellow will also learn more about the specific disorders being investigated using these tests, such as hemoglobinopathies, red cell enzyme deficiencies, other non-neoplastic red cell, white cell, and platelet disorders.

**Patient Care**

**Goal**
Fellows must be able to understand current diagnostic hematology instrumentation and the testing performed within hematology laboratories or automated laboratories that are appropriate to enable the effective diagnosis and treatment of disease processes.

**Competencies**
- Demonstrate a working familiarity with current analyzer instrumentation.
- Learn to recognize disorders with morphologic manifestations identified in peripheral blood, body fluids, and urine samples.

**Objectives**
- Fellow will observe the instrumentation features outlined above in the general rotation description.
- Fellow will increase his/her general skill in Laboratory Hematology with emphasis on cell types seen in peripheral blood, body fluids, and urine microscopy.
- Know when non-neoplastic red cell, white cell, and platelet disorders should be suspected and what laboratory tests should be performed to make a definitive diagnosis.

**Medical Knowledge**

**Goal**
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological features of disorders with hematologic aspects that present with abnormalities in peripheral blood smear or automated testing data (cell counts, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, etc.), as well as being able to apply this knowledge to patient care.

**Competencies**
- Learn normal and abnormal blood cell, body fluid, and urinary sediment morphology, including review of abnormal casts and crystals in urine sediment.
- Demonstrate an understanding of automated hematology, urinalysis and coagulation instrumentation and develop a familiarity with special hematology testing related to red blood cell, white blood cell, and platelet disorders related to red blood cell, white blood cells, and platelet disorders.
- Learn the criteria and basis for non-neoplastic hematologic disorders that are largely diagnosed by using results from a general or special hematology laboratory.

**Objectives**
- Review the major clinical aspects of disorders diagnosed by hematopathologists, concentrating on non-neoplastic disorders and clinically benign, but abnormal or atypical findings.
- Review of Peripheral Blood and Fluid Slide Study Set that can be checked out from the hematopathology secretaries (G306) (the directory of cases is in the resident’s drive).
- Fellows must also score competently on the hematopathology division objective test and achieve an acceptable score on the ASCP Fellows In-Service Examination.
- See also general description.

**Practice-Based Learning and Improvement**

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**Systems Based Practice**

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**Competencies**
- Understand how considerations of cost awareness and risk-benefit analysis play a role in deciding what tests a clinical laboratory should provide in-house versus send-out testing.
- Demonstrate an awareness of regulatory requirements as relevant to the operation of a modern hematology laboratory or laboratory section.
- Know quality assurance and quality control procedures.
- Understand how a complex patient-oriented clinical laboratory is managed, including the scope of testing, specific testing methodology, and documentation of test accuracy.

**Objectives**
- Participate in mock/interim Self-inspection College of American Pathologists laboratory inspection, when possible.
- Participate in faculty-supervised quality improvement projects, if possible.
- Review College of American Pathologist (CAP) checklist requirements in hematology that are utilized for most laboratory inspections and certification.
- Attend laboratory management and quality assurance / quality control meetings.
- Learn how electronic resources are used in a modern hematology or automated testing laboratory that includes hematology testing.

**Professionalism**

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**Interpersonal and Communication Skills**

See general description.

**Goal**
Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and teaming with other physician colleagues and professional associates.

**Competencies**
- Communicate effectively with hematology-oncology physicians and other healthcare professionals.
- Act in a consultative role to other physicians and health professionals.
- Function as a team player.
- Able to interact well with laboratory technical and managerial personnel.

**Objectives**
- Accurately convey information both orally and in writing to the submitting physician and other appropriate personnel (hematology-oncology fellows, nurse practitioners, physician assistants).
- Discuss possible treatment implications of laboratory findings with physicians and other appropriate health-care professionals.
- Demonstrate a familiarity with laboratory management principles, especially in regard to effective communication with laboratory professionals (technologists and management personnel).
- Demonstrate ability to seek consultations from members of the faculty or staff, as necessary.
- Demonstrates ability to communicate well with laboratory technical personnel.

**Teaching Methods**
- Direct review of abnormal blood smears and body fluid sample preparations at a multiheaded microscope with the primary attending pathologist, with one-to-one didactic and Socratic interaction.
- Use of teaching sets including:
  - Peripheral Blood and Fluid Slide Study Set that can be checked out from the hematopathology secretaries (G306) (the directory of cases is in the resident’s drive).
- Reading of various textbooks and original literature available within the hematopathology division, as well as procedure manuals.
- Direct observation of laboratory and analyzer operation, including direct observation of technologists and bench personnel.
- Observation of interactions between faculty directors and laboratory staff or supervisors, including attendance at laboratory management meetings.
- See also general description.

**Assessment Method (fellows)**
- Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
Laboratory Hematology Rotation Checklist: [Laboratory Hematology Rotation Checklist](#)
Hemoglobin Analysis Case Log: [HEMOGLOBIN ANALYSIS CASE LOG](#)
PB and Fluid Review Log: [PB AND FLUID REVIEW LOG](#)
See also general description.

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Fellows report directly to the faculty director of the hematology laboratory section of UPMC-Presbyterian Hospital. Fellows also interact with the hematopathology attending assigned to cover the automated testing laboratory for a review of abnormal blood and body fluid preparations, related testing issues, and review of send-out testing results on specific patients.

**Educational Resources**
Various hematology textbooks are available within the Division of Hematopathology and from individual faculty. Procedure manuals are available within the laboratory. The specific rotation checklist should also be used as a resource.

- Peripheral Blood and Fluid Slide Study Set that can be checked out from the hematopathology secretaries (G306) (the directory of cases is in the resident’s drive).
Hematopathology Fellowship
Coagulation

Description of Rotation or Educational Experience

The coagulation rotation for the Hematopathology Fellow is 4 weeks in length and located at the Institute for Transfusion Medicine, on the corner of Dawson and the Boulevard of the Allies (see detailed directions below). The fellows share a quiet office space located on the first floor Annex of the building and are provided with a syllabus of the most recent articles on coagulation. A small library including text and reference books, as well as a selection of hematology journals is available for fellow use. The fellows are expected to utilize their time when not performing the activities described below, taking advantage of these resources to assist in mastering the goals and objectives of this rotation.

On your first day, ask the receptionist at the ITxM front desk for the Systems Support Technologist (Karen Grasso, kgrasso@itxm.org), Laboratory Supervisor (Linda Parkinson), or one of the other fellows or residents and they will assist you with what to do and with whom to report. In the unlikely event that none of the above staff or residents are in, ask for Deb Small, Dr. Bontempo, Dr. Chibisov, or Dr. Kiss.

Clinical sign-out activities:
Once oriented to the daily routine of the laboratory, the fellow, along with the other fellows, residents, and medical students participating in the program will be provided with patient information from that given day’s laboratory blood samples. The material is divided among the rotation participants, and they are responsible for obtaining clinical information and histories from the referring or admitting physicians for each patient; generally done by computer with access to MARS or telephone. If there are no medical students on any given day, it is the responsibility of the fellow to obtain pertinent information on the patients through the electronic medical record or by calling the appropriate hospital or doctor’s office. This activity occurs in the afternoons beginning around 3:00 PM, except for the individual’s first day, at which time they should report by 2:30 PM.

Once the information is collected, the rotation participants meet as a group with one of the ITxM medical faculty for case sign-outs. This is the interpretation of the patient’s coagulation profile in relationship to the clinical findings (e.g., lupus anticoagulant). The results from the previous day’s testing are then discussed utilizing the clinical information that was obtained, providing the trainees with the link between the clinical histories/backgrounds, the test results, and ultimately how to provide a clinical diagnosis. This activity occurs in the late afternoons, usually beginning between 4:00-4:30 PM, and depending on how many cases there are, can last until approximately 6:00 PM.

Laboratory-based activities:
During the rotation, it is the fellow’s responsibility to schedule time to observe the performance of various coagulation testing; this can be done by contacting the coagulation laboratory supervisor.
Other activities:
The opportunity for small clinical research projects is available for interested fellows and their participation is encouraged and welcomed.

Patient Care
Goal
Fellows must be able to understand the various disorders that affect hemostasis in order to provide diagnostic information that is appropriate to enable the effective treatment of health problems and the promotion of health.

Competencies
• Become familiar with clinical coagulation issues.
• Develop the ability to interpret abnormal laboratory and clinical findings to make a specific diagnosis.
• Develop an understanding of how coagulation testing is performed and used in the evaluation and diagnosis of patients with abnormalities of the hemostasis pathways.
• Develop a working ability to consult on abnormalities of coagulation with other physicians and laboratory personnel.

Objectives
Learning Objectives Oriented to Patient Care:
• Understand how to formulate a written interpretive coagulation report. (Many of the reports use coded predefined text, but the fellow should understand how to formulate these or similar interpretations in practice.)
• Understand and be able to recommend therapeutic strategies for coagulation abnormalities.
• Be able to formulate testing algorithms for evaluating hemostatic problems or for the follow-up of abnormal findings.
• Be able to oversee a coagulation laboratory and provide coagulation-related consultations.

Daily Practical Expectations:
• The fellow will be provided with a list of patients each day on which coagulation studies are requested. The fellow will obtain appropriate patient clinical histories and indications for coagulation testing from review of electronic medical records, referring physician notes, and through direct conversation with the referring physician (generally by phone).
• Fellows will then present and/or discuss the clinical findings and laboratory results with the attending physician assigned (usually in afternoon).

Medical Knowledge
Goal
Fellows must demonstrate knowledge of basic coagulation biology (including its molecular basis), abnormal coagulation states, and therapeutic agents that affect coagulation (both those used for direct coagulation or anti-coagulation therapy and those used for other purposes, but secondarily affect coagulation). In addition, fellows must understand established testing methods for evaluation of coagulation abnormalities, as well as the application of this
knowledge to specific patient cases.

**Competencies**
- Demonstrate an understanding of coagulation testing, including abnormalities of the coagulation factor pathways and platelet function.
- Know the pathogenesis of basic coagulation disorders and how these are treated.
- Know the impact of exogenously administered agents (specific medications, blood-derived products, recombinant factors) used in treating or managing coagulation abnormalities as well as those that are used for other purposes but affect hemostatic parameters.

**Objectives**
- Learn normal and abnormal coagulation pathways.
- Review the major clinical aspects and the diagnostic criteria of coagulation disorders diagnosed by hematopathologists.
- Learn the specific tests utilized to define which pathway (thrombotic vs. platelet, for example) is affected, determine what the precise abnormalities are, and identify what additional testing is needed and know how these tests are performed.
- Learn which molecular assays are used to diagnose disorders characterized by hypercoagulation or other coagulation disorders.
- Obtain a score of competent on the test administered by Dr. Bontempo to assess the fellow's proficiency in understanding coagulation.
- Achieve an acceptable score on the spring administration of the Hematopathology Fellows In-Service Examination administered by the American Society of Clinical Pathologists (ASCP) (score above the 25th percentile).

**Practice-Based Learning and Improvement**
See general description.

**Systems Based Practice**

**Goal**
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

**Competencies**
- Understand how considerations of cost awareness and risk-benefit analysis play a role in deciding what coagulation tests are necessary.

**Objectives**
- Demonstrate to the coagulation laboratory attending physicians that s/he can effectively interpret coagulation testing utilizing a variety of resources in the health system and can choose the appropriate tests or panel of tests that will assist in making a specific diagnosis and treatment plan through daily sign-out discussions.
- Know how consultative coagulation services organizationally relate to other aspects of hematopathology, both within UPMC and elsewhere.
**Professionalism**
See general description.

**Interpersonal and Communication Skills**
See general description.

**Teaching Methods**
- Direct review of laboratory results on specific patients during daily sign-out and discussion.
- Reading of various textbooks and original literature available within the hematopathology division or at the Institute for Transfusion Medicine (ITxM).
- Direct observation of laboratory, analyzer operation, and direct observation or interaction with technologists.

**Assessment Method (fellows)**
- End of rotation written evaluations by attending faculty (based on direct supervision and observation).
- Direct examination administered by Dr. Bontempo or designee.

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Fellows report directly to the faculty of ITxM during this rotation.

**Educational Resources**
Various textbooks and resources, including a detailed syllabus are provided by the ITxM service while on the rotation. This includes a copy of the examination with final answers, given after fellows complete the examination for future reference. Additionally, a variety of hematology textbooks, most of which have chapters related to coagulation diagnosis and evaluation are also available within the Division of Hematopathology. Other textbooks focusing on coagulation testing are available in the Division of Hematopathology, as well.

**Directions to the Institute for Transfusion Medicine**
3636 Boulevard of the Allies, Pittsburgh, PA 15213, 412-209-7270:

From Tower View: After you exit Tower View, go down Fifth Avenue and turn left onto Halket Street. Cross Forbes Avenue and go past Magee Women’s Hospital to the intersection with the Boulevard of the Allies where Panera’s is on your left. Make left turn at that intersection staying in middle lane of the BOA until next traffic light that crosses over Bates St. at which point you will be in far right lane of the BOA. The next traffic light you pass through is Ward St. and when approaching the next traffic light, you will be at the intersection of Dawson and the Boulevard of the Allies and the pink brick building on your right is The Institute For Transfusion Medicine (ITxM). Continuing through the traffic light at Dawson (passing the ITxM building), make a right hand turn on the very next street past Dawson which is Parkview. Drive the length of the block to the next stop sign, make right onto Swinburne, and at the next stop sign, you will make another right putting you back on Dawson before the ITxM building. As
you now drive down Dawson, the ITxM building will be on your left and the parking lot is just before the building. Once parked, walk to the front of the building which is on Dawson and once inside the front door, the receptionist will buzz you in.

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<td>The purpose of this rotation is to increase fellow exposure to histiocytic (macrophage and dendritic cell) neoplasms and disorders, which are uncommon in general hematopathology practice. Fellows will spend two weeks of half-days rotating with Dr. Jennifer Picarsic at Children’s Hospital of Pittsburgh, who routinely signs out these cases as part of her pathology consult practice. Fellows will review all histologic material from biopsies performed at UPMC as well as consult cases, and sign out cases with Dr. Picarsic. In addition, fellows will have the opportunity to review study sets and case archives. Also see the Focused Histiocytic Neoplasms and Disorders Experience schedule for more information.</td>
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<tr>
<th>Patient Care</th>
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<tbody>
<tr>
<td><strong>Goal</strong></td>
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<tr>
<td>Fellows must be able to provide diagnostic interpretations of macrophage and dendritic cell neoplasms and disorders that are appropriate to enable the effective treatment and the promotion of health. Fellows are expected to:</td>
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<thead>
<tr>
<th>Competencies</th>
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<tbody>
<tr>
<td>• Demonstrate an ability to sign out neoplasms/disorders of the macrophage-dendritic cell lineages utilizing morphology and ancillary studies.</td>
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<tr>
<td>• Recognize the majority of histiocytic neoplasms and disorders that may involve tissues.</td>
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<thead>
<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>• Write concise diagnostic reports that include an accurate diagnostic interpretation and description, that are easily understood, as independently as current regulations allow.</td>
</tr>
<tr>
<td>• Be able to integrate genetic and immunophenotypic data in diagnostic reports.</td>
</tr>
<tr>
<td>• Learn the use of a multiparameter approach to the diagnosis of histiocytic neoplasms/disorders (morphology, flow cytometric and immunohistologic phenotypic studies, genotypic studies, cytogenetic studies and clinical data).</td>
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<tr>
<td>• Learn to diagnose a range of histiocytic and dendritic cell neoplasms/disorders seen in tissue biopsies.</td>
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<tr>
<th>Medical Knowledge</th>
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<tbody>
<tr>
<td><strong>Goal</strong></td>
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<tr>
<td>Fellows must demonstrate knowledge of established and evolving biomedical, clinical, and epidemiological features of histiocytic neoplasms and disorders, as well as knowing how to apply this knowledge to patient care.</td>
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<thead>
<tr>
<th>Competencies</th>
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<tbody>
<tr>
<td>• Have a basic understanding of the diagnostic criteria for histiocytic neoplasms and disorders.</td>
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</table>
- Know the major clinical aspects of histiocytic neoplasms and disorders.

**Objectives**
- Complete checklist that includes acquisition of general knowledge related to histiocytic neoplasms and disorders.
- Understand the pathobiology of histiocytic neoplasms and disorders.
- Write coherent diagnostic reports that indicate the ability to recognize histiocytic neoplasms and disorders.
- See also general description.

**Practice-Based Learning and Improvement**
See general description.

**Systems Based Practice**
See general description.

**Professionalism**
See general description.

**Interpersonal and Communication Skills**
See general description.

**Teaching Methods**
- Direct sign-out at a multiheaded microscope with the primary attending pathologist, with one-on-one didactic and Socratic interaction.
- Use of actual and virtual teaching sets of glass slides and case studies.
- Reading of various textbooks and original literature.
- See also general description.

**Assessment Method (fellows)**
- Monthly milestone electronic evaluations by attending faculty (based on direct supervision and observation).
- Multisource (360-degree) evaluation process.
- Review of histiocytic neoplasms and disorders rotation checklist with fellowship director or designee.
  - [Checklist Histiocytic and Dendritic Cell Neoplasms and Disorders](#)

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Dr. Jennifer Picarsic is assigned to cover the service. Fellows report directly to her, and she is ultimately responsible for the quality of all decisions made and for the reports signed out.

**Educational Resources**
- Lymph node chapter in Sternberg.
- Actual and virtual teaching sets of glass slides and case studies (Dr. Picarsic’s office).

| Hematopathology Fellowship  
Immunohistochemistry Laboratory Experience |
<table>
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<tbody>
<tr>
<td><strong>Description of Rotation or Educational Experience</strong></td>
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<tr>
<td>This is a brief rotation that is designed to familiarize the fellow with the daily operations of a high-volume immunohistochemistry laboratory. The microscopic review of high quality immunohistochemical stains is an integral part of the diagnostic evaluation of most bone marrow cases and tissue samples to be evaluated for possible lymphoma or other hematologically related disease. Furthermore, hematopathologists may also be responsible for the oversight of an immunohistochemistry laboratory in future practice.</td>
</tr>
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</table>

The fellow will report to the senior technologist in the Immunohistochemistry Laboratory when starting this 2-day rotation (see schedule). The laboratory technologists will oversee the fellow’s active participation in learning the technical and administrative issues involved in the operation of the immunohistochemical and general histology laboratory.

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<tr>
<td><strong>Goal</strong></td>
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<tr>
<td>Fellows must be able to understand the various steps involved in the production of high quality immunohistochemical stains in order to provide diagnostic information that is appropriate to enable the effective treatment of lymphomas, leukemias, myeloproliferative neoplasms, myelodysplasias, and various related diseases.</td>
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<tr>
<th><strong>Competencies</strong></th>
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<tbody>
<tr>
<td>• Become familiar with basic operations and management of immunohistochemistry laboratories.</td>
</tr>
<tr>
<td>• Develop a working understanding of the steps involved in various stains in order to trouble-shoot problems in clinical diagnostic practice.</td>
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<tr>
<th><strong>Objectives</strong></th>
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<tbody>
<tr>
<td>• Fellow will observe the set up and preparation of immunohistochemical stains.</td>
</tr>
</tbody>
</table>
- Learn some of the management issues involved in operating an immunohistochemistry laboratory.

### Medical Knowledge

**Goal**
Fellows must demonstrate a working knowledge of immunohistochemistry stain preparation and be able to apply this knowledge in their daily practice of sign-out and/or assessment of staining quality to ensure accurate diagnosis.

**Competencies**
- To understand theoretical basis and technical aspects of immunohistochemistry.

**Objectives**
- Learn the principles behind immunohistochemistry and the steps involved through practical observation and appropriate reading of textbooks, primary literature, and standard operating procedure manuals of the UPMC laboratory.

### Practice-Based Learning and Improvement

**Goal**
Fellows must demonstrate the ability to investigate and evaluate new knowledge to improve continuously patient care and diagnostic expertise, based on constant self-evaluation and lifelong learning.

**Competencies**
- Understand how to investigate and solve problems with specific stains.
- Know resources to keep abreast of changes in immunohistochemistry laboratories.

**Objectives**
- Investigate unusual staining results to determine if this may be an isolated problem with the specific stain or tissue or a more systematic problem with equipment or methodology.
- Know resources that the laboratory uses to learn about new developments in the field and to help in troubleshooting problems.

### Systems Based Practice

**Goal**
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

**Competencies**
- Know regulatory aspects related to supervision of an immunohistochemistry laboratory.
- Understand considerations of cost awareness and resource utilization when ordering immunohistochemistry stains.

**Objectives**
- Understand the regulatory requirements (College of American Pathologists, state and local, as
applicable) of immunohistochemistry laboratories with regard to inspection requirements and quality control.

**Professionalism**
See general description.

**Interpersonal and Communication Skills**
See general description.

**Teaching Methods**
- Direct interaction with laboratory technical staff.
- Reading of various textbooks, procedure manuals, and original literature available within the hematopathology division or within the laboratory.
- Direct observation of laboratory personnel and automated stainer operation.

**Assessment Method (fellows)**
- End of rotation written evaluations by staff.
- Immunohistochemistry Rotation Checklist: [Immunohistochemistry Rotation Checklist](#)

**Assessment Method (Program Evaluation)**
See general description.

**Level of Supervision**
Fellows report directly to the designated technical staff.

**Educational Resources**
- Immunohistochemistry laboratory procedure manual
- Dako and Ventana literature (available in laboratory)

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**Hematopathology Fellowship**

**Laboratory Management and Laboratory Decision Making**

**Description of Rotation or Educational Experience**
Training in laboratory management and decision making is basically a facet of all aspects of hematopathology practice. Training in this topic does not constitute a distinct block. Rather, it is spread across all other rotations. Fellows are considered integral members of the staff of the Department of Pathology and have the opportunity to participate in discussion of matters related to management of the hematopathology related laboratories. In addition to attending laboratory management meetings, at least as part of the flow cytometry and clinical hematology rotations, the faculty will actively involve fellows in acute and longer-term management issues. Fellows are also expected to be proactive in this regard. In addition, fellows are expected to complete a core set of online lab management courses provided through the ASCP Lab Management University program by the end of the fellowship year and are encouraged to complete CAP inspection team leader training if he/she has not already done so during
Patient Care

Goal
Fellows must be able to manage hematology-associated laboratories and to direct laboratory technologists and other personnel in order to provide cost-effective and accurate diagnostic or laboratory results that will aid in the effective treatment of disease. The objectives vary, depending on the specific rotation on which the fellow is working. All objectives are listed below for reference.

Competencies
• Be able to direct laboratory technologists and other personnel.
• Be able to assist laboratories in dealing with acute and more chronic problems.
• Be able to assist with questions of specimen handling.
• Have experience with direct responsibility for some laboratory activities.

Objectives
• Triage bone marrow specimens, fill out work-up requests, and tell the bone marrow technologists how to handle individual cases.
• Decide on initial flow cytometry panels and later on any additional studies needed and effectively communicate these decisions to the technologists.
• Triage fresh lymph node and related specimens by directing others.
• Advise the technologists in the hematology laboratories about technical, pathological, and other laboratory issues.
• Provide direct oversight of lymph node assistant.
• Be on call approximately one week out of four (after the first 2 months of fellowship), with faculty back-up when needed, but with primary responsibility for on-call decision making that includes direction of technologists in the hematology section of the Automated Testing Laboratory and in the flow cytometry laboratory, as well as making diagnostic decisions.

Medical Knowledge

Goal
Fellows must learn the basic principles of laboratory management and decision making.

Competencies
• Develop an appreciation for time-management and know how to direct appropriate support personnel in the provision of patient care.
• Understand the typical hierarchy of laboratories (bench technologist, technical specialist, lead technologist, supervisors, and laboratory managers) and what role each one plays.
• Understand the role of the pathologist laboratory director in various academic and other settings.
• Understand basic concepts of pathology laboratory leadership, personnel management, operations, financial management, compliance and laboratory informatics.

Objectives
• Demonstrate the ability to help manage appropriate support staff and personnel.
• Know how to organize a quality assurance and quality control program and understand the difference between these two concepts.
• Understand the roles of various laboratory directors at UPMC by observation of these individuals and discussion with them.
• Attend didactic session with laboratory senior administrative director or designee covering a variety of management centered topics, (i.e. types of facilities in which fellows may one day be working, private vs. employee physician models, medical director administrative responsibilities, and importance of communication skills and various types of employer and employee relationships).
• Attend at least one Lab Administrative Directors Meeting (contact Melissa Crandall and Donna Sciulli to schedule).
• Attend at least one Laboratory Leadership Meeting at UPMC-Presbyterian and/or UPMC-Shadyside.
• Complete 15 online lab management courses provided through the ASCP Lab Management University program. ASCP Lab Management University Checklist
• Complete CAP Inspection Team Leader Training (https://learn.cap.org/Activity/4662692/Detail.aspx).

Practice-Based Learning and Improvement

Goal
Fellows must demonstrate the ability to investigate and evaluate changes in testing offered, specimen volumes, and personnel staffing that may affect the organization and work-flow of the laboratory, based on constant self-evaluation and lifelong learning.

Competencies
• Use information technology to optimize learning.
• Demonstrate flexibility in personnel supervision that reflects newly acquired medical information or service needs.

Objectives
• Demonstrate progressive independence in specimen management, as assessed on bi-annual review with fellowship director.
• Investigate unusual results to determine if this may be an isolated problem with the specific stain or tissue or a more systematic problem with equipment or methodology.
• Demonstrate an awareness of changes in staffing that might affect how samples must be handled and by whom.
• Demonstrate ability to orient other fellows, residents, and students to the laboratory organization and triage of samples.

Systems Based Practice

Goal
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.
### Competencies
- Understand how the various laboratories relate to the larger laboratory structure.
- Understand the division of management between anatomic pathology and clinical pathology laboratory services.
- Develop a basic understanding of how the laboratory services relate to other clinical services and how this affects laboratory decisions as to what testing to provide.
- Understand the reasoning behind decisions to perform certain testing in-house versus sending out to an external laboratory.

### Objectives
- Develop an ability to direct and/or manage appropriate personnel to facilitate cost effective provision of healthcare, wherein all members of the team perform functions to which they are optimally suited or trained.
- Review send out test results when on the hematology laboratory rotation.
- Become involved in at least one quality control or quality assurance project.

### Professionalism
See general description.

### Interpersonal and Communication Skills
See general description.

### Teaching Methods
- Direct interaction with laboratory technical staff.
- Reading of various textbooks, procedure manuals, and original literature available within the hematopathology division or within the laboratory.
- Direct observation of faculty interactions and modeling of appropriate behavior.
- Didactic session with laboratory senior administrative director or designee covering a variety of management centered topics.
- Online lab management courses provided through the ASCP Lab Management University program.
- See also general description.

### Assessment Method (fellows)
See general description.

### Assessment Method (Program Evaluation)
See general description.

### Level of Supervision
Fellows report directly to the designated faculty covering a specific rotation and may seek advice directly or via telephone conversation or e-mail (if during an on-call or non-urgent situation).

### Educational Resources
- Individual faculty also acts as mentoring resource or provides additional texts on
principles of lab management.

- CAP Inspection Team Leader Training ([https://learn.cap.org/Activity/4662692/Detail.aspx](https://learn.cap.org/Activity/4662692/Detail.aspx)).