**Overview**

Hematology/Hematopathology training for WFBMC AP/CP residents is a multifaceted program designed to instruct the resident in the methods used for detection, analysis, and measurement of hematologic specimens, for interpretation and diagnosis of hematopoietic disorders. The overall curriculum consists of three specific educational and training components: (1) one month of Basic Hematology; (2) 3 months of Hematopathology; and (3) comprehensive Hematology/Hematopathology didactic lecture series. A fourth, optional component may be taken as an advanced elective following completion of the required rotations.

1. **Basic Hematology Rotation.** *Required.*

This one month rotation, taken during 1st year of residency, includes a series of daily didactic lectures, laboratory sessions, and examinations which focus on the subject of introducing Hematology from a laboratory perspective. Areas of study include automated instrumentation, differential cell morphology, coagulation, hemoglobin/protein electrophoresis, urinalysis/body fluids. Trainees gain experience in the management and medical supervision of the high volume Clinical Hematology Laboratories. Trainees additionally gain exposure to clinical consultation, primarily through clinical case presentations and slide reviews with the medical staff.

The Rotation Instructor is responsible for assigning specific educational/teaching responsibilities to the resident. The resident is expected to be an active participant while on the rotation.

*Satisfactory completion of the rotation is required prior to beginning the Hematopathology rotation.*

1. **Hematopathology Rotation.** *Required.*

Three months total in Surgical Hematopathology/Clinical Hematology Laboratories, taken during 2nd, 3rd, or 4th year of residency as 1, 2, or 3 month blocks. Time is spent within different laboratory sections, including:

* Surgical Hematopathology - morphologic examination and interpretation of bone marrow aspirates/biopsies and lymph nodes, extranodal tissues, and integration/correlation of pertinent ancillary phenotypic and genotypic studies
* Clinical Hematology Laboratory - performance/preparation and interpretation of bone marrow/peripheral blood staining for examination, and preparation and examination of body fluids, including urines, CSF, effusions, etc.
* Flow Cytometry Laboratory - phenotypic analysis on clinical specimens for CD34 stem cell enumeration, CD4/CD8 T-cell enumeration, lymphoma/leukemia immunophenotyping, etc.
* Special Hematology - performance/preparation and interpretation of procedures for hemoglobin electrophoresis, and serum/urine protein electrophoresis/immunofixation
* Participation in daily and weekly hematopathology conferences

1. **Comprehensive Hematology Course.** *Required.*

Didactic lecture series is given by the hematopathology fellows and faculty emphasizing the aspects of diagnosing hematological disorders. Areas of study include anemias, reactive leukocytic disorders, neoplastic hematology, bleeding/thrombotic disorders, and special ancillary diagnostic techniques. Attendance is mandatory. All absences must be approved by the Residency Program Director, Course

Director, or designee. Residents are expected to maintain any and all concurrent rotation activities/duties.

See attached Syllabus for more detailed information.

1. **Advanced Hematopathology.** *Elective.*

Senior residents who have satisfactorily completed the required Hematology and Hematopathology rotations may elect to take an additional one to two months of Advanced Hematopathology training. Responsibilities will include unsupervised, independent work in various, chosen lab sections, including the coagulation, flow cytometry, and/or hematology labs. The resident is expected to provide increased consultation, supervision, and liaison with laboratory medical technologists and junior residents to provide guidance with respect to reviewing, interpreting, and sign-out of daily laboratory reports.

This rotation will be arranged at the approval of both the Residency Program Director and the Rotation Director (or designees).

**Duration**

The required Hematology/Hematopathology training is a minimum of a total of four months, split into a one month of Basic Hematology (first year) and 3 month s of Hematopathology (2nd, 3rd, 4th years) blocks. Additional time for any of the required or elective rotations may be arranged at the approval of both the Residency Program Director and the Rotation Director (or designees).

*A maximum of two residents per rotation will be allowed.*

**Absences**

Given the curriculum and laboratory work flow requirements, scheduled time off for the Basic Hematology rotation will not generally be granted. Activities missed from unscheduled time off, e.g. sick time, will need to be made up. Excessive time off from the rotation will require remedial work as determined by the Rotation Instructor, Residency Program Director and Rotation Director.

A maximum of one week’s scheduled absence (vacation or locum tenens time) may be taken during the Hematopathology rotation. Such time is to be approved by both the Residency Program Director and Rotation Director (or designees) *prior* to beginning the rotation.

**Goals and Objectives**

Following successful completion of ***all required Hematology/Hematopathology*** training, the resident will:

* Understand the basis and diagnostic criteria for the classification scheme of hematopoietic disorders/neoplasms. Formulate differential diagnoses of hematopoietic disorders, through the correlation and interpretation and correlation of morphology, clinical data, and relevant phenotypic/genotypic ancillary studies. *[Medical Knowledge]*
* Provide detailed morphologic evaluation and interpretation of peripheral blood smears, body fluid preparations and bone marrow, lymph node, spleen and thymic specimens and other extranodal specimens obtained for the evaluation of reactive and neoplastic hematopoietic disorders. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Understand work-up of patients with anemia to include interpretation of hemoglobin electrophoresis, Heinz body stains, hemoglobin H stains, and osmotic fragility, etc., and be able to utilize this information in proposing laboratory test selection to establish diagnoses. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Learn interpretation and diagnosis of immunophenotypic analysis of hematolymphoid malignancies, including immunohistochemistry technology, flow cytometry, and cytochemistry. Correlate data with histologic findings. Describe the decisions involved in antibody selection. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement, Systems-Based Practice]*
* Learn molecular diagnostic applications and interpretation of hematopoietic lesions, including PCR, in situ hybridization, conventional cytogenetics procedures, and fluorescent in situ hybridization (FISH). Discuss the use of molecular assays in the diagnosis of hematolymphoid malignancies. Correlate data with histologic findings. Describe the decisions involved in test selection. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement, Systems-Based Practice]*
* Interpret hemoglobin electrophoresis, serum protein electrophoresis, and protein immunofixation assays. Become familiar with other tests, including plasma hemoglobin, serum viscosity, osmotic fragility, sickle solubility, and G6PD *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Understand work-up of patients with coagulopathies, including appropriate specimen collection and interpretation. Obtain proficiency/familiarity in interpretation with various coagulation procedures, including prothrombin time, activated partial thromboplastin time, thrombin time, fibrinogen determination, coagulation factor assays, coagulation factor inhibitor studies, fibrin-fibrinogen degradation product determination, bleeding time, platelet aggregation studies, and special molecular assays, etc. To be able to utilize this information in proposing laboratory test selection to establish diagnoses. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Understand the principles, interpret the findings, and know the clinical significance of normal and abnormal results obtained on urine specimens. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Understand importance of gathering and reviewing relevant previous pathologic studies and information   
  for correlative review *[Patient Care, Practice-Based Learning and Improvement]*
* Make management/triage decisions regarding lymph node and/or extranodal biopsies for possible use in ancillary studies, including flow cytometry, cytogenetics, paraffin immunohistochemistry,

molecular/genotypic analysis, and/or tissue culture as indicated *[Patient Care, Medical Knowledge, Systems-Based Practice]*

* Develop the ability to write concise, informative and comprehensive reports on specimens submitted for examination; to develop communication/liaison skills to discuss pertinent findings with submitting physicians, pathologists, laboratory staff, and serve as an effective consultant with clinicians *[Interpersonal and Communication Skills, Professionalism, Medical Knowledge, Systems-Based Practice]*
* Obtain current literature or information in the field of hematopathology *[Practice-Based Learning and Improvement, Professionalism]*
* Discuss issues of quality assurance and lab administration related to hematology laboratories. Be familiar with and participate in Quality Control, Automation/Instrument operation, LIS, and lab management. *[Practice-Based Learning and Improvement, Systems-Based Practice]*
* Demonstrate competence in the use of microscopic photography, including digital imaging technology through active participation and presentation in conferences. Recognize role as a important member of hematopathology diagnostic team and role as educator *[Medical Knowledge, Practice-Based Learning and Improvement, Professionalism, Interpersonal and Communication Skills]*

**Basic Hematology Rotation** *required, 1st year*

The resident will spend one month during 1st year residency training in the Clinical Hematology Laboratories to learn the basic principles and operation of the general Clinical Hematology Laboratories. The resident will be instructed in basic and advanced morphology of marrow and peripheral blood, and perform differential counts. The resident will identify normal and abnormal blood cells/features, and assess WBC, RBC, and platelet morphology on a daily basis. While in the general hematology laboratory, the resident will be required to assist in the marrow aspirate slides and biopsy touch preparations, stain samples, and participate in trouble shooting/triaging specimens.

Urinalysis and medical microscopy training for residents is part of the rotation course in which the residents receive specific hands on training and expertise including urine physical characteristics, urine chemical tests, aminoacidurias, and urine sediment. Practice case studies are used in addition. Other areas of study include standard dip-stick urinalysis testing as well as automated urinalysis instrumentation. Medical microscopy for cellular morphology and crystal and cast identification is studied. Medical microscopy of cerebrospinal, pleural, peritoneal, synovial and bronchoalveolar lavage (BAL) specimens is covered. The resident is expected to be available for consultation during the day for interpretation of morphologic findings, and issue a referral report form. Abnormal and unusual microscopy findings and all BALs are referred to cytology.

Other tests the trainee will become familiar with include plasma hemoglobin, serum viscosity, osmotic fragility, sickle solubility, and G6PD. The resident will help to process patient samples from start to finish using automated cell counters and integrated/interfaced laboratory computer systems, and learns principles of procedure, reagents, equipment, and materials.

**Resident Responsibilities**

On the first day of the rotation, the resident will meet with the Rotation Instructor to establish a detailed schedule.

Education level specific goals and objectives for first year resident:

* Learning indications, principles, logistics, and general operation procedures for laboratory reagents and equipment in processing hematologic samples *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* List laboratory normal values and state reasons, both technical and biochemical, for abnormal values *[Patient Care, Medical Knowledge]*
* Preparing of marrow aspirate slides, biopsy touch preps, peripheral blood smears, and body fluids *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Performing bone marrow (500 cell count) and peripheral blood (100 cell count) differentials *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Processing and interpreting other special hematologic work-ups, e.g. serum viscosity, osmotic fragility, sickle solubility, G6PD, etc. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
* Processing and interpreting urinalysis and medical microscopy of cerebrospinal, pleural, peritoneal,   
  synovial fluid and bronchoalveolar lavage (BAL) specimens. *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
  + Discuss the pathophysiology of various disease states and their associated laboratory findings by evaluating erythrocyte and leukocyte morphology and maturation, identification of abnormal cells in the bone marrow and peripheral blood, hemoglobin electrophoresis results, coagulation theory and testing, urinalysis chemical tests and results, and comparison of cerebral spinal fluid, serous fluid, and synovial fluid
* Evaluate acceptability of patient results based on QC, disease state, and previous values *[Practice-Based Learning and Improvement, Systems-Based Practice]*
* Follow standard safety precautions at all times in the laboratory *[Professionalism, Practice-Based Learning and Improvement, Systems-Based Practice]*
* Presenting 15 minute didactic for laboratory staff CE *[Medical Knowledge, Practice-Based Learning and Improvement, Professionalism, Interpersonal and Communication Skills]*
  + Attending specific conferences, including the Hematology/Oncology Case Conferences, Hematopathology Consensus Conference, and Laboratory Quality Assurance/Improvement. See details below for conference descriptions and activities. *[Professionalism, Practice-Based Learning and Improvement, Systems-Based Practice]*

Satisfactory performance in the Basic Hematology Rotation will be demonstrated by obtaining an average final grade of 86% or better on the tests, quiz, final exam, resident evaluations, laboratory practicals, and resident laboratory grade, otherwise requiring remediation (see below).

See attached Basic Hematology Syllabus for more detailed information.

**Hematopathology Rotation** *required, 2nd, 3rd and/or 4th years*

The resident will complete a minimum of three months time during their 2nd, 3rd, and/or 4th years of residency training. The resident will rotate through each of the laboratory sections in such variable time as required to develop proficiency in the above goals and objectives. Graduated responsibilities will include unsupervised, independent work in the lab sections.

**Resident Responsibilities**

On the first day of the rotation, the resident will meet with the Rotation Instructor, on-service Hematopathology Attending and/or Hematopathology Fellow for orientation and to establish a detailed schedule. A typical rotation will include hands-on performance and interpretation experience in the following areas:

1. Surgical Hematopathology

Over the course of the Hematopathology rotation the resident participates in the evaluation and sign-out of adult and pediatric hematopoietic disorders, which includes correlating peripheral blood data, marrow aspirate smears, trephine core biopsies/clot sections, nodal/extranodal tissues, as well as any/all relevant phenotypic/genotypic ancillary studies, including flow cytometry, cytochemical and immunohistochemical stains, molecular/cytogenetic studies. In addition, the resident is responsible for gathering and reviewing relevant previous pathologic studies and information from patient’s medical record.

All studies are reviewed in detail and final sign-out of cases will be done with the attending hematopathologist at a multi-headed microscope, correlating the relevant clinical and biological features into a final diagnosis. As graduated responsibility, the resident is required for dictation of the final report, with appropriate levels of guidance from the attending physician, and is expected to work nearly independently by the end of rotation. The resident is also responsible for contacting the appropriate submitting clinician, and communicating unexpected or urgent results. The resident will ultimately be able to discuss the pertinent findings with the submitting physician, and to serve as an effective consultant.

Education level specific goals and objectives for the resident:

* + - Learning/practicing indications, principles, logistics, and general operation procedures for processing/triaging surgical hematopoietic samples *[Patient Care, Medical Knowledge, Practice-Based Learning and Improvement]*
    - Morphologic examination of marrow aspirate slides, biopsy touch preps, peripheral blood smears, and trephine core biopsies *[Patient Care, Medical Knowledge]*
    - Morphologic examination of lymph node biopsies and other lymphoreticular specimens *[Patient Care, Medical Knowledge]*
    - Correlation with clinical presentations/features *[Patient Care, Medical Knowledge]*
    - Diagnostic/interpretation and correlation with phenotypic analyses, including cytochemistry, immunohistochemistry, and flow cytometry *[Patient Care, Medical Knowledge]*
    - Diagnostic/interpretation and correlation with genotypic analyses, including PCR, in situ hybridization, FISH, cytogenetics/karyotypic analysis at daily Cytogenetics Sign-Out *[Patient Care, Medical Knowledge]*
    - Schedule meeting for daily sign-out/rounds with faculty for case reviews *[Professionalism, Interpersonal and Communication Skills]*
    - Formation of final integrative written report, including benign or malignant bone marrow and lymphoid specimens, in a timely manner (to be completed on the day the specimen is received) and pass the completed report to the attending pathologist. All pertinent laboratory data, including CBCs, flow cytometry results and special stains should be used in generating this provisional report. The attending staff pathologist will review each case with the resident via a multi-headed microscope, or give immediate follow-up on any disagreements in the resident’s provisional report and the final report. *[Medical Knowledge, Practice-Based Learning and Improvement, Professionalism, Interpersonal and Communication Skills]*
    - Liaison and consultation with other pathology or clinical services, e.g. Cytopathology, Hematology/Oncology, etc. *[Interpersonal and Communication Skills, Professionalism, Medical Knowledge, Patient Care, Systems-Based Practice]*

1. Flow Cytometry Laboratory

The resident spends time rotating through the flow cytometry laboratory to learn the basic principles and operation of the flow laboratory. The resident uses the first experience of the rotation to follow at least one specimen of each type from accession, through specimen preparation, cell staining, acquisition on the flow cytometer, results analysis, interpretation of results and report generation. Practical points such as pitfalls vs. advantages, direct versus indirect staining, whole blood lysis vs. gradient separation, quality control, gating practices, and computer analysis are all discussed.

As graduate responsibilities, the resident is expected to review the histograms and slides on all leukemia/lymphoma or other hematologic cases, complete the write-up sheet, and present the case to the attending hematopathologist. The resident will be expected to communicate the results to the submitting physician and correlate the flow cytometry findings with other studies available for review, e.g. paraffin section, cytogenetics, and molecular diagnostics.

Education level specific goals and objectives for the resident:

* + - * Reviewing the histograms and slides on all leukemia and lymphoma cases *[Patient Care, Medical Knowledge]*
    - Completing the write-up sheet and presenting the case to the pathologist. The resident is involved in result reporting under the supervision of the attending physicians and lab directors in each section. The resident will participate in, but is not primarily responsible for, interpretation and sign-out of final patient reports under the supervision of the attending hematopathologist *[Medical Knowledge, Patient Care, Practice-Based Learning and Improvement, Professionalism, Interpersonal and Communication Skills]*
    - Report and communicate the results to the submitting physician, with other pathology or clinical services, e.g. Cytopathology, Hematology/Oncology, etc. *[Interpersonal and Communication Skills, Professionalism, Medical Knowledge, Patient Care, Systems-Based Practice]*

* + - * In addition to the routine, daily, clinical work research projects are available. *[Practice-Based Learning and Improvement]*

1. Special Clinical Chemistry/Hematology

The rotation in the Specialty Hematology Section includes instruction in serum and urine protein electrophoresis, immunofixations, and hemoglobin gel electrophoresis, including both acetate and agar

electrophoresis procedures. The resident will learn correlation and integration with CBC data, peripheral blood smear morphology, clinical features, and other relevant laboratory data (direct antiglobulin test, reticulocyte counts, serum heptoglobin, serum bilirubin, etc.) to arrive at a diagnosis.

Education level specific goals and objectives for the resident:

* + - * Interpretation of procedures for hemoglobin electrophoresis, and serum/urine protein electrophoresis/immunofixation assays *[Patient Care, Medical Knowledge]*
    - Written/result reporting under the supervision of the attending physicians. The resident will participate in, but is not primarily responsible for, interpretation and sign-out of final patient reports under the supervision of the attending hematopathologist *[Interpersonal and Communication Skills, Professionalism, Medical Knowledge, Patient Care, Systems-Based Practice]*
    - The resident will be expected to report and communicate the results to the submitting physician. *[Interpersonal and Communication Skills, Professionalism, Medical Knowledge, Patient Care, Systems-Based Practice]*

**Concurrent Activities**

* + 1. Conference attendance/presentations - see below for descriptions of activities.
    2. Laboratory Quality Assurance/Improvement
    - Review/interpretation of abnormal laboratory reports, i.e. "Path Box Referral Forms" in the Core Hematology Laboratory. As part of required resident participation in laboratory Quality Assurance programs, the resident is responsible for reviewing, interpreting, and sign-out of daily abnormal laboratory reports, with completion of Path Box Referral Form, in accordance with the Hematopathology/Clinical Microscopy criteria/guidelines in the Resident Reference Manual.
      * Weekdays, 8 AM - 5 PM: Hematology/Hematopathology resident(s)
      * All other times: On-Call Resident

This is a graduated responsibility, as junior residents may need assistance or consultation with hematopathology fellow and/or attendings. Any cases not resolved are brought to the attention of the hematopathology fellow/attending pathologist for presentation and discussion typically at a multi-headed microscope. This review of problem slides often includes body fluid slides such as CSF, joint fluids and urine, and HbF by the Kleihauer-Betke staining method.

* + - Participation in CAP surveys and/or laboratory inspections
    - Attend the monthly WFBMC Clinical Pathology Core Laboratories QA Meeting

1. Bone Marrow Biopsy/Aspirate Training

As part of their Hematopathology training, residents can perform bone marrow biopsy and aspiration procedures. This training experience is provided and directed by the Hematology/Oncology Division of the Department of Internal Medicine. If interested residents are expected to contact Bone Marrow Laboratory staff for scheduling (6-2614).

1. Self-Study/Teaching
   * + - * The resident is expected to utilize the extensive reference materials available in the section, including standard clinical pathology, hematology and coagulation reference books. In addition there are numerous supplementary textbooks, web-based materials, extensive slide study sets, ASCP CheckSample and CheckPath case studies, and CAP cases available for self-study.
         * During the rotation the resident will able to perform pertinent/topical literature reviews, and review current laboratory hematology journals and clinical pathology journals. Additional reading materials on specific topics can be obtained from the Attendings.
         * Participate in the instruction of rotating medical students, residents, and other clinical fellows
2. Optional activities

* Clinical Hematology Laboratory

The resident may elect to spend time in the Clinical Hematology Laboratories to refresh and advance skills learned in the Basic Hematology rotation, including basic and advanced morphology of marrow and peripheral blood, and perform differential counts. The resident will assist in the marrow aspirate slides and biopsy touch preparations, stain samples, and participate in trouble shooting/triaging specimens. Additional training for urinalysis and medical microscopy of fluids may be obtained. The resident is expected to be available for consultation during the day for interpretation of morphologic findings, and issue a referral report form.

* Coagulation and thrombopathies - rounds with a clinical hematologist with expertise in coagulopathies and thrombopathies, as well as the laboratory tests utilized in their diagnoses, is a requirement of the Blood Bank rotation (see the objectives of that section), however, additional time may be given during the core hematopathology rotations at the discretion of the director or attending Hematopathologist.
* Research - develop specific project, including case report, abstract, or paper for publication.
* Laboratory management - The resident may be involved in the screening and implementation of new techniques or methods introduced into the surgical hematopathology service for diagnostic or research purposes.

**Graduated Responsibilities**

Advancement of higher responsibility is based on evidence of satisfactory progressive scholarship and professional growth. As such, graduated responsibilities are not expected during the Basic Hematology rotation. The resident will, over the course of their Hematopathology rotation, work towards graduated responsibilities to include overseeing/managing case sign-out duties and conference unsupervised and independently. The resident will be assigned graded service responsibilities based on the individual’s performance. Expectations/duties for residents will include increase caseload work-ups, increased conference participation and presentation, as well as unsupervised, independent work in the Core Hematology Laboratories.

Specific activities include:

* + Residents initially will be given limited caseload (1-2 cases/day), and will be expected to carry more caseload burden, 3 or more per day near the end of their training. This includes the formation of final integrative written reports, including benign or malignant bone marrow and lymphoid specimens, in a timely manner (to be completed on the day the specimen is received) and pass the completed report to the attending pathologist. All pertinent laboratory data, including CBCs, flow cytometry results and special stains should be used in generating this provisional report.
  + As training progresses, the fellow will be expected to make management/triage decisions regarding lymph node biopsies, as well as a wide variety of extranodal lymphoreticular lesions.
  + Full participation and presentation in conferences is required.
  + Residents returning to specific laboratory areas for further training during their fourth year are expected to assume a higher level of responsibility in the laboratory, including more hands on experience with specimen preparation, cell staining, data acquisition, results analysis, interpretation of results and report generation.
  + The senior resident is expected to provide increased consultation, supervision, and liaison with laboratory medical technologists and junior residents to provide guidance with respect to reviewing, interpreting, and sign-out of daily laboratory reports.

**Advanced Hematopathology.** *Elective.*

Senior residents who have satisfactorily completed the required Hematology and Hematopathology rotations may elect to take an additional one to two months of Advanced Hematopathology training. Responsibilities will include unsupervised, independent work in various, chosen lab sections, including the coagulation, flow cytometry, and/or hematology labs. The resident is expected to provide increased consultation, supervision, and liaison with laboratory medical technologists and junior residents to provide guidance with respect to reviewing, interpreting, and sign-out of daily laboratory reports.

This rotation will be arranged at the approval of both the Residency Program Director and the Rotation Director (or designees).

**Conferences/Presentations**

1. **Bone Marrow Rounds** *-* *daily*.

During the Hematopathology and Advanced rotations, the resident attends these daily clinicopathologic correlation conferences. Marrow Rounds are a primary didactic specialty-specific conference performed at a multi-headed microscope, held in conjunction with the Clinical Hematology team to review all current bone marrow specimens. The rounds allow the resident to interact with the Clinical Hematology team on a daily basis. Topics include case-relevant pathobiologic features, treatment and therapeutic options, prognostic factors, etc., with both Attending Hematopathologist and Attending Clinical Hematologist. The resident participates in teaching of fellows, junior residents, medical students, in morphologic evaluation and interpretation of peripheral blood smears and bone marrow specimens.

1. **Cytogenetics Sign-Out** *- daily.*

During the Hematopathology and Advanced rotations, the resident attends and participates in the daily cytogenetics and molecular genetics sign-out of current hematopoietic malignancies, including acute/chronic leukemia, myeloproliferative neoplasms, myelodysplastic disorders, and lymphoproliferative disorders. Topics of discussion principally relate to correlating cytogenetic and molecular data with all case work-ups as part of a multi-modality diagnostic approach.

1. **Hematology/Oncology Case Conference** *– 2nd, 4th Wednesday of month*.

Residents on all rotations (Basic Hematology, Hematopathology, Advanced) attend and participate in this bi-monthly case-based interdisciplinary conference held in conjunction with the Section on Hematology/Oncology, Department of Internal Medicine, in which the residents/fellows present and discuss morphologic features, pertinent laboratory findings, and diagnostic interpretations of cases. As a graduated responsibility, case presentations (one or more) are assigned by the Hematopathology Fellow or Attending, as the resident acquires more experience, typically during the second rotation. The resident is responsible for review of appropriate diagnostic materials, digital photography, and presenting cases using digital presentation formats.

1. **Hematopathology Consensus Conference** *– 1st, 3rd, 5th Wednesday of month*.

Residents on all rotations (Basic Hematology, Hematopathology, Advanced) attend and participate in this monthly intradepartmental case conference held by Attending Hematopathologists, and involving the entire Hematopathology Section, other AP/CP Attendings/Fellows/Residents. Discussion involves presentation of cases posing problematic or difficult diagnosis, cases representing particularly atypical or typical pathologic characteristics, and/or any case of interest. Relevant journal articles are also presented for discussion. Residents may present current cases, with varying degrees of difficulty depending on level of training/experience in advance of the conference. The resident is responsible for higher-level contributions in case discussions, including review of relevant/current literature on the topic, review of pertinent pathology materials, including previous pathology and ancillary studies, be knowledgeable about clinical and laboratory findings, and be able to discuss diagnostic interpretations.

1. **Clinical Pathology Case Conferences** – *2nd and 4th Thursday of month*

Residents on all rotations (Basic Hematology, Hematopathology, Advanced) attend and participate in this bi-monthly case-based interdisciplinary conference held in conjunction with the Sections of Clinical Pathology. Residents present and discuss specific hematologic cases, including morphologic features, pertinent laboratory findings, and diagnostic interpretations of cases. The resident is responsible for review

of appropriate diagnostic materials, digital photography, and presenting cases using digital presentation formats, if appropriate.

1. **Clinical Pathology Core Laboratories QA Meeting** *– 4th Thursday of month*

During the Hematopathology and Advanced rotations, the resident attends the monthly QA Hematology Administration meeting to gain further experience in managing a Hematology Laboratory, including instrument maintenance, quality control problems, technical staffing issues, capital equipment procurement, and triaging of performance of high-cost/low volume tests, appropriate record keeping, etc. The resident may be involved in the screening and implementation of new techniques or methods introduced into the surgical hematopathology service for diagnostic or research purposes.

**Evaluations and Milestones**

**Resident**

The resident will be evaluated by the rotation faculty/staff and Hematopathology Fellows. Methods of evaluation will include direct observations by attending faculty, 360 evaluations by clinical laboratory staff, "on-the-fly" spot evaluations, oral/written/unknown case work-ups, and written documentation of activities including procedure/case log and conference presentations. Resident assessment will be based on performance in the following areas:

* Daily morphology sign-out/rounds
* Daily review of written provisional reports
* Assistance and availability to the attending Hematopathologists

**Faculty/Rotation**

At the completion of each rotation, the resident will be given the opportunity to evaluate the rotation and the faculty.

**Milestones**

Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced. Evaluation of Milestones will be made in consultation with Residency Program Director for the semi-annual reviews of resident performance. As part

of the overall Hematology/Hematopathology training, residents will work in achieving the target milestones designated as level 3 and 4. Examples of milestones include, but are not limited to:

* Preparing full consultative reports with comprehensive review of medical records on common and uncommon hematologic diseases *[Patient Care]*
* Prioritizing and presenting patient care issues for report after call, applying standardized procedures for failed critical value call-backs, and appropriate specimen triaging protocols *[Patient Care]*
* Effectively communicating preliminary results on cases in progress, including clinically significant or unexpected values and critical values *[Patient Care, Interpersonal and Communication Skills, Professionalism]*
* Understanding analytic issues and quality control for advanced precision diagnostics, including understanding potential confounding factors that may contribute to erroneous results *[Patient Care]*
* Preparing and leading discussion on developing a focused differential diagnosis based upon clinical information and/or abnormal laboratory results *[Medical Knowledge, Patient Care, Interpersonal and Communication Skills]*
* Interfacing with clinical team to recommend tests, based upon current literature, and suggests evidence-based management, prognosis, and therapeutic recommendations based on the consultation, and prudently applying justification for approval of costly testing *[Patient Care, Systems-Based Practice]*
* Interpreting ancillary phenotypic (flow cytometry, immunohistochemistry) and genotypic (molecular, cytogenetics, FISH) testing results in clinical context with full integration into comprehensive report *[Medical Knowledge, Patient Care]*
* Performing scientific literature review and investigation of clinical cases to inform patient care (evidence-based medicine) and improve diagnostic knowledge of pathology *[Medical Knowledge, Practice Based Learning and Improvement]*
* Teaching across departments and at all levels, including to clinicians, patients, and families *[Medical Knowledge]*
* Preparing, presenting, and leading case discussions at multidisciplinary conferences *[Interpersonal and Communication Skills]*
* Developing a portfolio of clinical consultation experience and scholarly activities, which may include manuscript preparation, abstract presentation at a local, regional or national meeting, or other scientific presentation *[Professionalism, Practice Based Learning and Improvement]*
* Anticipating team needs and takes leadership role to independently implement solutions *[Professionalism]*
* Participating in new instrument and test selection, verification, implementation, and validation (including reference range analysis) and maintaining a portfolio of participation of these experiences *[Systems-Based Practice]*
* Able to correctly use Current Procedural Terminology (CPT) and ICD9 (ICD10) codes for billing purposes *[Systems-Based Practice]*
* Demonstrating knowledge of proficiency testing and its consequences *[Systems-Based Practice]*

**Remediation**

For any evaluation of less than satisfactory performance, for whatever reason, the Rotation Director/Supervisor will:

1. Discuss the evaluation with both the resident and Residency Program Director immediately. The Rotation Director shall document the interactions with the resident in writing, with a copy placed in the resident’s file.
2. Outline in written form what remedial work will be required to complete the rotation satisfactorily and establish criteria and time frames for the correction of the deficiencies.
3. Notify the Residency Training Committee of the unsatisfactory evaluation, and submit the mutually agreeable plan for remedial action for Committee approval.
4. Re-evaluate compliance with corrective actions as established earlier. The Residency Program Director, Rotation Director/Supervisor, and/or additional designees, will be the final judge(s) of the resident’s remedial work. If the resident fails to correct the identified academic deficiencies to the satisfaction of the Program Director and Rotation Director/Supervisor within the specified time frame, the Rotation Director/Supervisor may either extend the remediation period, using the same procedures as for an initial remediation effort, or proceed with disciplinary/hearing review and/or termination in accordance with the processes described in WFBMC House Staff Policy and Procedures (NCBH-HSS-14, 15). See: <http://www.wakehealth.edu/School/Physician-Services/House-Staff-Policies.htm>

**Faculty/Staff**

Nancy S. Rosenthal, M.D., Hematopathology (AP/CP Program Director)

Michael W. Beaty, M.D., Hematopathology (Director of Hematopathology)

David D. Grier, M.D., Hematopathology (Director of Flow Cytometry)

Stacey S. O’Neill, M.D., Hematopathology (Director of Molecular Pathology)

Steven Wong, Ph.D., Clinical Chemistry (Director of Clinical Chemistry)

Mark Pettenati, Ph.D., FACMG (Director of Cytogenetics)

Andrew Farland, M.D., Clinical Hematology (Director of Coagulation Laboratory)

Natalie Walker, MT ASCP, Hematology Specialist (Flow Cytometry)

LuAnn Mascorro, MT ASCP, Hematology Specialist (Basic Hematology Rotation Instructor)

**Resources**

1. **Reading Materials**

The Hematopathology Section library has an extensive library devoted to Neoplastic and Normal Hematopathology, Laboratory Medicine, and Clinical Oncology. A partial listing of available textbooks includes:

Coleman, WB. Molecular Diagnostics for the Clinical Laboratorian, 2nd Edition. Human Press. 2006.

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1. **Electronic:**
   * + A large list of flow cytometry resources, including the Flow cytometry E-mail user group, maintained by Purdue University: <http://www.cyto.purdue.edu/index.htm>
     + Johns Hopkins University flow cytometry online tutorial: <http://162.129.103.34/leuk/toc.htm>
     + WFUBMC flow cytometry online tutorial: <http://intranet.wfubmc.edu/pathology/teaching/hempath/flow_cytometry/index.html>
     + Atlas of Genetics and Cytogenetics in Oncology and Haematology:

<http://www.infobiogen.fr/services/chromcancer/>

* + - Online Mendelian Inheritance in Man:

<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=OMIM>

1. **Study Sets**

Extensive case library has been established and maintained with original case data and pertinent patient history. These collections are an excellent resource for adjunctive teaching as well as an outstanding study material.

* + - All diagnostic material including glass slides & reports of bone marrow and lymph node material, archived since the 1950s, are available for review
    - Flow Cytometry case folders
    - Detailed volume Glass Slide Study Set with approximately 1000 slides
    - Hemoglobin and serum/urine protein electrophoreses, immuno fixations
    - ASCP CheckSample Case Series in Hematology, 2003 - present
    - ASCP CheckPath Slide Series in Hematopathology, 2010 - present
    - CAP Surveys
    - Study sets from Society for Hematopathology workshops, each containing microscopic slides (+/- 100) with accompanying clinical data, panel lists diagnoses, and discussion notes.
    - Hematology RISE examination practice questions
    - Platelet aggregation study sets