**Hematopathology at University of Minnesota Medical Center, Fairview**

The purpose of this rotation is to learn the morphologic changes of neoplastic and non-neoplastic hematologic disorders in the blood, bone marrow, and lymphoid tissues. In addition, this rotation is designed to teach resident efficient and cost effective use of ancillary studies in conjunction with morphology to making appropriate diagnoses in hematopathology. The residents are also instructed in the proficient performance of bone marrow aspiration and biopsy procedures of the posterior iliac crests.

**Institutional Site Director**
Anthony Killeen, MD, PhD

**Coordinating Teaching Faculty Member**
Robert W. McKenna, MD

**Teaching Faculty Members**
Elizabeth Courville, MD
Vanessa J. Dayton, MD
Bartek Grzywacz, MD
Michael Linden, MD, PhD
Robert McKenna, MD
Sarah Williams, MD
Sophia Yohe, MD

**Laboratory Staff**
Nancy Geier, Laboratory Supervisor, 612-273-3282
Mary Schmalz, Technical Lead, 612-273-5542

**Training Site:**
University of Minnesota Medical Center, East Bank

**Duration of Rotation:**
2 months (2 rotation periods required)

**Post Graduate Level of Residents Involved**
PGY 1-5

**Supervisory Guidelines for Patient Care and Specimen Handling:**

- At the beginning of the rotation, all residents are taught to perform the bone marrow aspiration and biopsy procedure by one of the faculty members or one of his/her designees.
• After the faculty member or his/her designee determines that the resident is competent and capable of performing the bone marrow aspiration and biopsy procedure, the resident will be allowed to perform the procedure, but even then only when a faculty member or his/her designee is on site and available for immediate backup.
• All preliminary and final diagnoses are rendered only after the cases have been reviewed by a faculty member or his/her designee with the resident.
• When appropriate, input is sought from the resident on issues related to the management and operations of the laboratory. Decisions that affect laboratory policy will be made after discussion with and approval by the faculty or his/her designee.

**Daily Duties and Responsibilities:**

• Initiate chart review, contacts with the patient's physician, or do what is necessary to obtain the patient's relevant history (for example: drugs, esp. growth factors; medical and family history; environmental exposure...)
• Gather available archival material on each case. This should be done from inside the University (Main Hematology, Special Hematology, and Surgical Pathology) as well as from outside the University. In particular lymph node biopsies should be obtained on all patients being staged for lymphoma.
• Obtain information from the cytogenetics, immunophenotyping, flow cytometry, or molecular diagnostic laboratories on difficult or ambiguous cases. Review with the teaching faculty the contribution of such data to the final diagnosis.
• The resident should be able to competently perform a bone marrow aspirate and biopsy from the posterior iliac crest.
• The resident will learn to review slides of blood, marrow, and lymphoid tissues, formulate a differential diagnosis, propose a diagnostic work-up, and discuss such plans with the faculty or his/her designee during daily sign-outs.
• Write an accurate, literate, complete but succinct report in less than 24hrs., after the last clinically relevant study is completed (usually this means section material but in some cases it may be special stains).
• Residents should be able to recognize morphologic findings that would have critical impact on the patient's immediate medical management.
• Participate in Thursday (in-service) conferences: the resident is expected to be able to take a disease entity or a syndrome, carry out a selected review of the literature and present a 20-30 minute summary, with handouts limited to a single page front and back including the bibliography.
• During the second rotation the resident should be able to perform and interpret 3 bone marrow biopsies/day (consult material included) and interpret 2-4 peripheral blood smears/day. The resident at this time should be able to communicate the appropriate findings to the clinical house staff and attending physicians.

**Goals and Objectives:**
• Know the type of specimens required for evaluation of the following diseases as well as when to order them (see below for examples). Have a working knowledge of the clinical presentation, morphologic features, and diagnostic criteria for:
  a. Myeloproliferative disorder - cytogenetics, bcr-abl, and LAP.
  b. Lymphoma - bilateral biopsies, gene rearrangements, immunophenotyping, and cytogenetics (depending on the case).
  c. Acute leukemia - cytogenetics, immunophenotyping, and bcr-abl.
• Know the procedure for and be able to competently perform a bone marrow biopsy and be able to evaluate the adequacy of a specimen.
• Know the following stains, the principles of the stain and what they stain: CAE, LAP, Heinz body, Reticulocyte, Kleihauer Betke (Hb F), TdT, MPO, SBB, NSE, TRAP, Reticulin, Iron stains (both Dacie and storage iron), PAS, GMS, and Fite.
• Know the basic CD antigen profile for erythroid, megakaryocytic, monocytic, granulocytic, lymphoid malignancies.
• Have and interpret flow cytometric data, immunocytochemical data and molecular data reviewed before case sign out.
• Know the limitations and how to interpret the common immunohistochemical stains used in the laboratory (LCA, L26, UCHL1, anti-MPO, Lysozyme, HbA, Kappa and Lambda).
• Know how to work up an anemia. Know the tests required and what to suggest: CBC with differential, Fingerstick blood smear, Reticulocyte determination, DAT, Heinz body prep, fetal hemoglobin, coagulation profile, Hgb A2, hemoglobin electrophoresis, Sickle cell test, isopropanol stability test, FEP, serum B12 and Folate, Red cell folate, Iron studies, Osmotic fragility, etc. Understand the principles of these tests and their limitations.
• Understand the biology of the Thalassemias and the hemoglobinopathies.
• Know the FAB criteria, clinical presentations, and morphologic features for MDS, AML, ALL. Know the differential diagnosis for agranulocytosis. Know therapy related MDS (median onset, predisposing factors, prognosis, cytogenetics).
• Know characteristics of reactive leukocyte disorders and be able to distinguish them from malignant conditions.
• Know the blood and marrow manifestations and the pathobiology of the most common storage diseases (Hurler, Gaucher, Niemann Pick, etc.)
• Know the current classification of non-Hodgkin's lymphomas and the Rye classification of Hodgkin's disease. Know how to diagnose these disorders and distinguish them from reactive lymphadenopathy and what appropriate ancillary tests will help you.
• Be able to define and recognize dyserythropoiesis, dysgranulopoiesis, and dysmegakaryopoiesis.
• Know the NCI criteria for remission in acute myeloid leukemia.
• Know the criteria for the diagnosis of the myeloproliferative disorders.
• Know the significance of cytogenetic abnormalities and their relation to hematopoietic malignancies.
• Know the blood and marrow findings in non-Hodgkin's lymphoma, Hodgkin's disease and related disorders.
• Know the blood and marrow findings in ITP, anemia of chronic disease, iron deficiency anemia, megaloblastic anemia, aplastic anemia, PNH.

**Opportunities to Function as Consultant to Other Physicians:**

• The resident is expected to communicate the results of his/her examination with the clinical services; such communication will include appropriate indications as to whether the case and the finding have been reviewed by the faculty. Such communication can take place at the microscopes, over the telephone or in person.

• In the process of gathering relevant laboratory data for the diagnosis, the resident may also interact with the faculty and staff of other laboratories within the Department such as Cytogenetics, Flow Cytometry and Immunophenotyping, Molecular Diagnostics, and Surgical Pathology.

**Call Duties:**

The resident is expected to be available to laboratory personnel, either in person or by pager, throughout the working day. No on-call duties outside of regular laboratory working hours are assigned to the resident. A hematopathology fellow/medical fellow specialist is on-call by pager after hours. All after-hour calls are supervised by the faculty who is on-call by pager and is available on site.

**Communication with On-Duty Faculty:**

Teaching faculty members on service are physically present during standard operating hours (8:00 AM - 5:00PM); specific faculty members when not physically present in the laboratory are available by phone or pager. At all times, a supervising faculty member is on call for evening and week-end questions. No final diagnosis is communicated to clinicians before a faculty member has evaluated the case.

**Structured Formal Education in the Management of the Cytogenetics Laboratory:**

The residents may also become involved in management issues, as they arise during the course of the workday. Some of these issues may be further discussed in the daily focused tutorial sessions with the teaching faculty.

**Required Conference/Seminars:**

• **Hematologic Malignancy Conference:** First and third Monday of every month, 4:15-5:15 p.m. Discussion of challenging cases, presented by Hematology-Oncology staff from UMMC, HCMC and VAMC. Staff and residents from Cytogenetics, Molecular Diagnostics and Flow Cytometry attend and present applicable results and discuss their significance. This clinical conference provides trainees with the opportunity to correlate and discuss pathologic findings.
• **Clinical Pathology Conference**, Tuesdays 7:30-8:30 a.m., weekly, residents and faculty present and discuss interesting clinical pathology cases, recent advancements in clinical pathology, and the interpretation of laboratory values in terms of a clinical setting. This conference provides a weekly forum for trainee and faculty discussion of difficult and unusual cases. The conference is composed of both a 30 minute resident and 30 minute faculty presentation. Residents develop their presentation under the guidance of a faculty member with whom they are currently rotating. This conference provides trainees with the opportunity to correlate and discuss pathologic findings.

• **Laboratory Medicine Grand Rounds**, Wednesday, 8:00-9:00 a.m., weekly, residents attend conferences on a variety of basic science and clinical topics. Conference is held on the University of Minnesota Medical School Campus.

• **"Unknown" Conference**, Thursday, 8:00-9:00 a.m., weekly, residents review a set of unknown cases and prepare a differential diagnosis. This conference provides a weekly forum for trainee and faculty discussion of difficult and unusual cases. The residents are expected to have a plan for reaching a final diagnosis for each case if additional studies are necessary. Residents must also be familiar with the clinical implication of their diagnoses.

• **Rosai/Sinard Conference**, Friday, 7:15-8:00 a.m., weekly, residents present a variety of real cases on a theme related to a recent or up-coming faculty Resident’s Conference. This conference provides a regular avenue for trainee peer teaching with feedback given by the Chief Resident’s Subcommittee.

• **Resident’s Conference**, Friday, 8:00-9:00 a.m., weekly, residents attend conferences on a variety of scheduled pathology topics given by the faculty.

• **Intradepartmental Special Hematology and Cytogenetics Conference**, monthly, interesting cases from the prior month are discussed in terms of their morphologic and cytogenetic findings. This conference provides a forum for trainee and faculty discussion of difficult and unusual cases. This conference provides trainees with the opportunity to correlate and discuss pathologic findings.

**Scholarly Activities and Research During Rotation:**

Residents are provided with continuous access to literature searching programs. The expectation is that residents will utilize the medical literature to find up-to-date information on their cases. It is further expected that residents will utilize the medical literature to help provide our clinical colleagues with up-to-date knowledge related to the cases they complete. During sign-out of cases, the residents and teaching faculty discuss each case, both from a histologic perspective and a scholarly perspective. In discussing the latter, the resident and faculty discuss both normal and abnormal physiology and the mechanisms potentially responsible for creating the morphologic findings observed. It is hoped that these discussions will foster an interest in research and the development of new knowledge. Residents are encouraged to become involved in research projects with the teaching faculty.

**Basis and Method of Resident Evaluation:**
Within the first month of the rotation, faculty in the Division of Hematopathology will meet with the residents to provide feedback, especially if there are any potential areas of difficulty.

The residents are provided with continuous feedback on their performance of daily activities (described previously), during the rotation. In general, only deficiencies are noted in writing. Residents are evaluated on their demonstrated ability to provide informative consultation to the clinical service teams, their medical knowledge, their application of this knowledge to efficient/quality patient care, and their microscopic diagnostic, technical and observational skills. Residents are also evaluated on their interpersonal skills, professional attitudes, reliability, and ethics with members of the teaching faculty, peers, laboratory staff, and clinicians. They are further evaluated on their initiative in fostering quality patient care and use of the medical literature, as it relates to their assigned cases. Their timely completion of assigned interpretive reports is another component of the evaluation. Residents on probation receive a written mid-rotation evaluation.

**Educational Resources Available:**

- Thursday Lecture Series
  - Acute Myeloid Leukemias Nguyen
  - Myelodysplastic Syndromes Nguyen
  - Acute Lymphoblastic Leukemias Nguyen
  - Myeloproliferative Disorders Nguyen
  - Disorders of Small Lymphocytes Nguyen
  - Lymphomas Nguyen
  - Multiple Myeloma Nguyen
  - Laboratory Hematology Geier
- Slide Study Sets:
  - Archival Material - In house and Consult Material; Accessed through computer print out.
  - Hematology CD-ROM - Fellows' Room and Biomedical Library.

**Computer Information Systems Available for Resident Education and Service Duties:**

Patient data can be accessed by using three computer systems in the laboratory:

- The KDS system for University of Minnesota Medical Center, Fairview laboratories.
• The Abaton system (accessed via the Internet) for University of Minnesota Medical Center, Fairview Patient Information, medical records, radiology, tissue pathology, and laboratory data.
• The Co-Path system for anatomic pathology results on the patients.

Literature searches can be performed via the network-based system in the Laboratory, via the computers in the residents' room, or via the computers in the University of Minnesota Biomedical Library.