PATHOLOGY RESIDENCY PROGRAM
Department of Pathology
Brigham and Women's Hospital
Boston, MA

2012-2013
TRAINING IN ANATOMIC AND CLINICAL PATHOLOGY AT THE
BRIGHAM AND WOMEN’S HOSPITAL

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Glenn Spiro of the Pathology Informatics Division, and multiple Residents and Fellows provided the Departmental photos.

Photos on Front Cover (Clockwise from upper right corner)

Key features of a slide are shown to a surgeon in the Frozen Section Room

Residents, fellows and faculty members share diagnostic pearls at the Hematopathology Interesting Case Conference

A resident describes his latest clinical research project to a faculty member at the Department of Pathology Research Celebration

A resident and faculty member discuss a specimen in the Frozen Section Room

Center: A view of Brigham and Women’s Hospital looking West on Francis Street. The new Shapiro Cardiovascular Center, housing the Department of Pathology’s Center for Advanced Molecular Diagnostics, is at left, connected to the main buildings by a bridge over Francis Street.
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TRAINING PROGRAM OVERVIEW

INTRODUCTION

A core mission of the BWH Department of Pathology is the training of leaders in the art and practice of Pathology and physician-scientists that can transform diagnosis and therapy through an understanding of mechanisms of disease. For decades, the BWH Department of Pathology has recruited the most talented trainees, provided first-class instruction in the clinical aspects of the evolving discipline, and integrated a strong and multi-faceted approach to education, research, and service, with the foundation of a top-to-bottom Departmental ethos of opportunity and mentorship enabling a broad diversity of career paths.

The training experience is organized around key themes:

- Recruitment and ongoing mentoring of the most talented residents and fellows with strong interest in Academic Pathology
- Highly-flexible, cutting edge and hands-on clinical-diagnostic training in Pathology and its subspecialties
- Emphasis on advanced molecular diagnostics and medical/bio-informatics technologies and clinical/research applications in Pathology
- Innovative educational programs and teaching and educational leadership opportunities at all levels, from undergraduate teaching at Harvard Medical School to postgraduate and continuing education at the national level
- Robust and abundant mentored basic-translational-clinical research training opportunities
- An intellectually-stimulating environment and collegial workplace that promotes career development

Departmental educational programs encompass Residency and Clinical Fellowship Training, Undergraduate Medical Education, and Continuing Medical Education. Dr. Frederick Schoen, as Executive Vice Chair, and Dr. Richard Mitchell as Vice Chair of Education oversee the Departmental educational programs.

RESIDENCY TRAINING

The Residency Training Program has long been a flagship of the BWH Department of Pathology and, with the growth of the Department and clinical service lines, is associated with multiple ACGME-accredited and institutionally-approved subspecialty fellowships. Dr. Gayle Winters is the Director of the Residency Program and is responsible for residency recruitment and education across Anatomic Pathology (AP) and Clinical Pathology/Laboratory Medicine (CP). Dr. Neal Lindeman is Associate Residency Program Director. Dr. Richard Mitchell oversees Career Development Mentoring for Physician-Scientists from the Resident/Fellow level through Junior Faculty level.
The Residency Program at the Brigham and Women’s Hospital provides both depth and breadth of training in AP, CP, or AP/CP. The Residency is accredited for 38 residents total and there are approximately 30 clinical fellows in the Department, in both accredited and non-accredited surgical pathology and subspecialty programs.

All residents gain strong clinical-diagnostic skills. Historically, the majority of our Resident Trainees have pursued academic careers and many have become national leaders in Pathology. Consequently, the Training Program is designed to meet the full certification requirements of the American Board of Pathology, while maximizing flexibility towards a spectrum of career goals. It does so by emphasizing achievement of core competencies in contemporary diagnostic AP and/or CP (including Transfusion Medicine), graduated responsibilities, and a large menu of advanced elective experiences, fellowship opportunities in pathology subspecialties, teaching and leadership opportunities, and basic, translational or clinical research. The training program is continually evolving and improving, building on the input of Trainees, Faculty, and external experts. Changes are also implemented as needed to meet the specific requirements of the American Board of Pathology, the career needs of our residents, our clinical volume and subspecialty mix, and evolving technologies.

The **key strengths of our training programs** include:

- Highly talented residents and fellows with professed interest – and often – previous accomplishments as physician-scientists and/or clinically-oriented leaders in Academic Pathology.

- A faculty comprising a multifaceted and collegial community of highly committed and interactive professionals, with a shared value system that emphasizes excellence, mentoring, and collaboration; many are established or emerging academic leaders.

- A rigorous core program in AP, CP, or AP/CP characterized by high and diverse clinical specimen volume, with emphasis on direct resident-faculty contact, resident involvement in clinical decision-making, communication with clinical colleagues, clinical innovation, and understanding mechanisms of disease.

- An extensive and highly structured curriculum that emphasizes hands-on training and active learning in rotations and an extensive curriculum of conferences and tutorials, most designed especially for resident education.

- Subspecialty rotations/sign-outs, with graduated responsibilities that provide added diagnostic experience.

- Flexibility to concentrate full-time in AP or CP subspecialty(ies) of choice, CP core rotations (for AP/CP) or laboratory research, beginning in the third year, following the core experience.

- Extensive exposure to state-of-the-art technologies, including flow cytometry, fine needle aspiration (FNA), cytogenetics and molecular diagnostic techniques, and Pathology-related medical informatics and computational biology.
• High program flexibility, with an emphasis on supporting a broad array of individualized goals.

• A strong tradition of trainee mentoring, including mentorship provided by fellow residents, clinical fellows, junior and senior Faculty, and alumni of the program.

• Extensive opportunities to participate in basic, bench-to-bedside (translational), and clinical research with strong mentoring in the Department and elsewhere at BWH, Dana Farber Cancer Institute, Harvard Medical School, Massachusetts Institute of Technology (MIT), and the broader biomedical research community in Boston.

• Opportunities to teach medical students in pathology and pathophysiology courses at Harvard Medical School, and in clinical rotations at the hospital.

• A strong track record of academic achievement, career development, and leadership roles of our trainees.

• Strong stability of both the training programs and the Department, with the capacity to adapt to changing training and practice needs and opportunities, such as advanced molecular diagnostics in personalized medicine and pathology medical- and bioinformatics and digital imaging.

THE ENVIRONMENT

The Pathology Department at the Brigham and Women's Hospital provides all patient care services in Pathology for the Brigham and Women's Hospital, the Dana Farber Cancer Institute (DFCI) and the Brigham and Women’s Faulkner Hospital, as well as consultative services to the Boston Children’s Hospital, Harvard Vanguard, and the Boston Medical Examiner's office. Academic collaborations with Harvard Medical School, Massachusetts General Hospital, Children’s Hospital, and Beth Israel Deaconess Medical Center are abundant.

Brigham and Women's Hospital

A primary teaching hospital of the adjacent Harvard Medical School, the Brigham and Women's Hospital (BWH) is a 777-bed private, not-for-profit hospital with a full-time clinical and affiliate staff of 2,276 physicians. BWH is known worldwide for its high quality and innovative patient care, cutting edge translational and clinical research and training, and a collegial and collaborative culture. The hospital has been named one of the nation's “10 Best” by U.S. News and World Report throughout the last decade. The clinical volume and breadth available to trainees at the BWH is exceptional: annually there are approximately 45,000 admissions; 55,000 emergency department evaluations; and more than 950,000 ambulatory visits. The surgical services cover a wide range of surgical specialties, including general, oncologic, cardiac, thoracic, orthopedic, neurological, genitourinary, and gynecologic surgery, as well as transplantation, including approximately 65 kidney, 25 heart, and 20 lung transplants per year. There is a separate bone marrow transplant service performing over
300 transplants per year. The medical services include internal medicine, cardiology, endocrinology, gastroenterology, rheumatology, oncology, hematology and dermatology. The gynecology and obstetrics services are extremely active, with nearly 9,000 births per year. Relationships among pathologists and clinicians are excellent, and collaborations (and opportunities for new collaborations) are extensive.

BWH is located in Boston’s “Longwood Medical Area” adjacent to Harvard Medical School, the Countway Medical Library, Children’s Hospital, the Dana-Farber Cancer Institute, and the Harvard Schools of Dental Medicine and Public Health. BWH is within easy commuting distance by public transportation of downtown Boston and the neighboring communities of Brookline, Jamaica Plain, Brighton and Cambridge; it is a short driving distance from most Boston suburbs. The patient population is derived from several sources, including a local inner city neighborhood, a suburban population, HMOs that serve a large, diverse primary care population, and an extensive tertiary care referral service.

BWH currently sponsors 45 ACGME-accredited specialty and sub-specialty programs with 877 residents and fellows. The hospital supports an extensive research program, which includes over 1000 primary investigators and 800 research fellows with total research expenditures topping $370 million (64% attributed to NIH grants). The BWH Biomedical Research Institute (BRI) is the umbrella organization for all research efforts at the hospital. The BRI offers a new paradigm for research at BWH which groups research into thematic centers, and technology-based platforms and cross-cutting programs to enhance collaboration among disciplines and dissolve barriers that inhibit such collaboration.

Since 1993, the Brigham and Women's Hospital and the Massachusetts General Hospital (MGH) have collaborated through the Partners HealthCare System, participating in an integrated health care network (the Partners Community HealthCare System [PCHI]) and various initiatives to strengthen the research and teaching missions of these hospitals. Now mature and thriving, this close affiliation has enhanced patient services and clinical programs, research and training, and administrative and support services. This arrangement is not a hospital merger. Although the Departments of Pathology at BWH and MGH have many shared projects and collaborative programs, they remain distinct and independent. The training programs in Pathology at the BWH and MGH separately recruit and select residents, design curricula, administer rotations, and provide mentoring. Nevertheless, a byproduct of the BWH-MGH affiliation is the creation of enhanced opportunities for broadened residency and fellowship training, especially interinstitutional subspecialty elective rotations and collaborative fellowships in Dermatopathology, Molecular Pathology, and Pathology Informatics.

**Dana Farber Cancer Institute**

The Department of Pathology at BWH provides virtually all of the pathology services at DFCI. The Dana Farber Cancer Institute (DFCI) is an internationally-known comprehensive cancer center with 1,036 admissions and 208,745 out-patient visits a year, and an active bone marrow transplant program for both hematopoietic and solid organ malignancies. It has historically provided a wide variety and large number of carcinomas, sarcomas, and hematopoietic malignancies for diagnostic evaluation and review by BWH pathologists, and a large fraction of the autopsies done by the BWH Autopsy Service. In 1996, a unified adult medical oncology program combining the patient care and clinical research strengths of DFCI, Brigham and Women's Hospital, and the Massachusetts General Hospital was formed.
(Dana-Farber/Partners Cancer Care). As a major feature of this joint venture, all 57 DFCI inpatient beds were moved into the Brigham and Women's Hospital in 1997. The BWH Department of Pathology continues to perform the diagnostic pathology and clinical laboratory services for these inpatients as well as DFCI ambulatory patients, including a large volume of consultation specimens. Moreover, most clinical laboratories of the DFCI have merged with those of the Brigham and Women's Hospital.

**Children's Hospital Boston**

Children's Hospital Boston (CHB), one of the largest pediatric medical centers in the US, is an international referral center and primary health care facility with 377 inpatient beds, approximately 17,000 admissions, 450,000 outpatient visits, 22,000 surgeries, 9,000 surgical specimens, and 86 autopsies annually. There is a large oncology and hematology service, as well as an active transplant program, including bone marrow, liver and heart. BWH Pathology residents and subspecialty fellows see relevant pediatric pathology at CHB and rotate there as part of their training in transfusion medicine.

**Brigham and Women's Faulkner Hospital**

Brigham and Women’s Faulkner Hospital is a 150-bed community hospital located in the Jamaica Plain section of Boston. It offers complete medical, surgical, and psychiatric care, as well as a full complement of emergency, ambulatory, and diagnostic services making it a dynamic leader in providing community-responsive health care. The Pathology Department at Faulkner Hospital is a Division of the BWH Department of Pathology. The Faulkner Breast Center provides a strong resource for collaborative pathology teaching and research programs. Advanced rotations emphasizing a community-based approach to the practice of pathology are available at Brigham and Women's Faulkner Hospital.

**Harvard Vanguard**

As New England's first and largest health maintenance organization, Harvard Vanguard cares for over half a million patients in over 23 centers. With a large number of its inpatients admitted to BWH, Harvard Vanguard provides a considerable number of pathological specimens that are examined by the Pathology Department at the Brigham.

**Office of the Chief Medical Examiner**

The Office of the Chief Medical Examiner (OCME), located in downtown Boston, is a dedicated medical examiner facility constructed in 1995. It includes the offices for the State Police Crime Scene Services, a radiology suite, trace evidence collection facilities, anthropology lab, and dental examination facilities. The OCME is staffed by seven full-time medical examiners, two part-time medical examiners, a part-time Forensic Anthropologist, and a part-time Forensic Osteologist. The OCME performs approximately 3000 autopsies annually.
THE DEPARTMENT OF PATHOLOGY

The BWH Department of Pathology employs a broad range of state-of-the art diagnostic services; the Department continuously strives to improve its effectiveness, efficiency and safety, and develops innovative new technologies that translate to improved diagnosis, therapy and prevention of disease. Four distinct units, functionally integrated over the past decade, carry out the patient care mission of the Department of Pathology.

- **Anatomic Pathology** services, including Surgical Pathology and the organ/system based subspecialties (including Women’s and Perinatal Pathology, Hematopathology, and Neuropathology), and Cytopathology and Autopsy Pathology,
- **The Clinical Laboratories**, including Chemistry, Hematology, Microbiology, and several subspecialty laboratories.
- **The Blood Bank/Transfusion Medicine and Cellular Therapies Service**, incorporated into a joint program comprising BWH, DFCI and Children's Hospital, and governed by a tripartite board.
- **The Center for Advanced Molecular Diagnostics**, comprised of Cytogenetics and Molecular Diagnostics in the new BWH Shapiro Building, completed in 2008, which has strong links to and integrates features of each of the other major units.

Each is supported by a **Pathology Informatics** Division, initiated in 2001.

The Department of Pathology of the Brigham and Women’s Hospital has approximately 100 full-time faculty, 60-65 residents and clinical fellows, and 65 research fellows. Although the clinical and research activities are organizationally separately, they are closely integrated and interactive, a feature critical to the Department's ability to recruit academically- and research-oriented trainees and to contribute to advances in diagnostic pathology. Many of the investigators in the Department have had clinical training, and also have appointments and duties in the clinical divisions, and virtually all “clinicians” in the Department do basic, translational, or clinical research.

The Faculty

The Faculty of the Department of Pathology at the Brigham and Women's Hospital is integral to the tripartite mission of the Department, and is also central to the Brigham and Women's Hospital's stature as a leading academic medical center. The Faculty members have highly diverse professional training, expertise, and professional responsibilities and duties. Most faculty members divide their professional effort among clinical, investigative and teaching activities, in varying proportions. These facets of their practice are closely integrated, interactive and synergistic—features significant in the Department's ability to recruit and retain academically and research-oriented trainees and Faculty, and to contribute to advances in diagnostic pathology. Many of the investigators in the Department have had clinical training and have appointments and duties in the Clinical Divisions. Likewise, virtually all “clinicians” in the Department do basic, translational or clinical research, and are academically productive. Overall, the Faculty is comprised of approximately 35% fulltime clinicians (who contribute to patient care at least 32 weeks annually, adjusted for variability of intensity of different service responsibilities), 40%
clinician-scientists with a lesser clinical service load and major laboratory-based and/or translational research responsibilities, and 25% primarily laboratory-based, basic researchers. The current faculty roster includes 38% women and there are 4 faculty members from underrepresented minority groups. Half of our current Faculty have completed either Residency or Fellowship training in our Department—subsequently progressing from Trainee to Faculty status.

BWH Pathology faculty members contribute broadly through their individual and collaborative efforts to the tripartite mission of an academic Department of Pathology: patient care, investigation and teaching. Collectively, our faculty is a multifaceted and extraordinarily collegial community of highly committed and interactive professionals, with a shared value system that emphasizes striving for excellence, mentoring, and collaboration. A key feature of the clinical practice is a strongly subspecialty-oriented model of patient care services, dependent on close and well-developed lines of communication with clinicians on all key clinical service lines across BWH and DFCI. The goal is not only to practice good medicine that will benefit an individual patient, but also to continuously ask “what diagnostic improvements would better serve the next patient(s) with the same condition?" The subspecialization extends far beyond mere subspecialty sign-outs, in that the patient care mission is well-meshed and synergistic with strong teaching and research objectives.

The BWH Department of Pathology, as one of the most research-intensive departments of its type in the country, has a cadre of basic, translational and clinical investigators focused on issues relevant to the pathophysiology and pathogenetic mechanisms of disease; it also has a longstanding tradition of contributing to clinical diagnostic and therapeutic innovation. These laboratories are available to trainees for mentored research. For example, the joint DFCI-BWH Center for Molecular Oncologic Pathology (CMOP) translates discoveries made in cancer pathobiology and genetics into targeted cancer diagnosis and treatment; it validates and translates a broad range of clinically useful biomarkers into practice. Finally, the Faculty members of the BWH Department of Pathology include many internationally-recognized experts across pathology subspecialities, who author or edit leading textbooks in their areas, contribute extensively to undergraduate and graduate courses nationally and internationally, and teach enthusiastically in our Training Program.

Department Faculty Members play a major role in the teaching of pathology to medical and graduate students in the Harvard Medical School and the Harvard-MIT Program in Health Sciences and Technology curricula. Department Faculty also are major contributors to Pathology teaching in Harvard’s Continuing Medical Education (CME) courses, as well as nationally in the educational programs of Pathology organizations, such as the United States and Canadian Academy of Pathology, American Society of Clinical Pathologists, and American Society for Investigative Pathology.

Clinical Programs

The BWH Department of Pathology provides the entire spectrum of pathology services across both the BWH and the Dana-Farber Cancer Institute in a clinical service line-oriented model, as well as consultative services for specimens originating externally. Indeed, the BWH Department of Pathology is a vital component of the Dana-Farber/Brigham and Women's Cancer Center, which is dedicated to comprehensive, integrated care for adults with cancer and is consistently ranked among the top comprehensive cancer centers in the
country. The BWH Pathology clinical services are marked by the:
- amount and diversity of their case material
- quality and depth of faculty
- responsiveness to patient and clinician, clinical research, and training needs

The organization of the Department and particularly the clinical services is characterized by subspecialization. This extends far beyond mere subspecialty sign-outs, in that the patient care mission is well-meshed and synergistic with strong teaching and research objectives. Indeed, virtually all the Anatomic Pathology subspecialties, including Women’s and Perinatal Pathology, Neuropathology, Hematopathology, GI Pathology, Soft Tissue Tumor Pathology, Dermatopathology, Cytopathology, Renal Pathology, Breast Pathology, Pulmonary Pathology and Cardiovascular Pathology are headed by senior nationally and internationally known pathologists. These services are staffed by subspecialty-trained faculty members and have integrated clinical and translational research programs; the majority run nationally recognized ACGME approved training programs. Moreover, BWH Pathology faculty members who provide clinical diagnostic service are also actively involved in research and educational efforts that broadly impact the training of physicians and the standard of care. Most staff members divide their time among clinical, investigative and teaching activities, in various proportions.

Dr. Jeffrey A. Golden is Chairman of the Department
Dr. Frederick J. Schoen is Executive Vice-Chairman
Dr. Gayle L. Winters is the Residency Program Director
Dr. Milenko Tanasejovic is Director of the Clinical Laboratories Division
Dr. Leslie Silberstein is Director of the Joint Program in Transfusion Medicine (collaborative with DFCI and Children’s Hospital)
Senior/emeritus professors include Dr. Joseph (Mac) Corson.

Anatomic Pathology

Anatomic Pathology has separate Divisions and Subspecialty Services:
Surgical Pathology directed by Dr. Christopher Fletcher
Women's and Perinatal Pathology directed by Dr. Christopher Crum
Autopsy Pathology directed by Dr. Gayle Winters
Neuropathology directed by Dr. Rebecca Folkerth
Cytopathology directed by Dr. Edmund Cibas
Cytogenetics directed by Dr. Cynthia Morton
Molecular Diagnostics directed by Dr. Neal Lindeman
Breast Pathology: Dr. Susan Lester
Cardiovascular Pathology: Dr. Gayle Winters
Dermatopathology: Dr. George Murphy
ENT Pathology: Dr. Jeffrey Krane
Gastrointestinal Pathology: Dr. Robert Odze
Genitourinary Pathology: Dr. Michelle Hirsch
Hematopathology: Dr. Jon Aster
Pulmonary Pathology: Dr. John Godleski
Renal Pathology: Dr. Helmut Rennke
Soft Tissue Pathology: Dr. Christopher Fletcher
Although diagnostic Surgical Pathology is heavily subspecialized, we continue to maintain General Surgical Pathology sign-outs to allow a more integrated style of training for pathology residents. Each of these subspecialty services conducts an active program in translational and/or clinical investigation, and basic research in some instances, allowing substantial integration among the clinical and research programs of this large department, enabling residents and fellows to be exposed to established physician-scientists as role models.

The Anatomic Pathology Services receive diagnostic tissue samples or body fluids obtained during surgery, biopsy via percutaneous needle (fine needle aspiration, bone marrow biopsies, amniotic fluid) or endoscopic procedures, and exfoliative cytology samples from inpatients and outpatients at the Brigham and Women's Hospital and the Dana-Farber Cancer Institute. In 2011, 75,000 Surgical Pathology specimens (22,000 from outside slide consultations) were accessioned, processed and interpreted; 49,103 Cytopathology specimens (2603 from outside slide consultations) were also analyzed. This is one of the highest volume diagnostic pathology practices in an academic center in the U.S., comprising a broad range of interesting, complex and educational material—heavily enriched for “high acuity” cases. There is an extensive pathology support staff including eight Masters-level Pathology Assistants, Pathology technicians, and an administrative and secretarial staff.

Clinical Pathology

The BWH Clinical Laboratories Division comprises the Hematology, Chemistry, Immunology, Microbiology, Endocrine-Reproductive, and Tissue Typing Laboratories at BWH and clinical laboratories at 850 Boylston St., Brookside Community Health Center, the Southern Jamaica Plain Health Center and the Laboratories at the new Foxborough facility. In 2011, the BWH Clinical Laboratories processed 4.8 million tests: 2.5 million on inpatients, 1.8 million on outpatients and 0.5 million in conjunction with institutional/special accounts. The Division also is responsible for clinical, regulatory and administrative oversight of the DFCI Clinical Laboratories and coordination of Point of Care testing.

The Blood Bank/Transfusion Medicine Service (itself comprising the Transfusion Service, DFCI Kraft family Donor Center, Therapeutic Apheresis and Cell-based Therapies units) is also a most active clinical laboratory. These entities all fall under the Joint Program in Transfusion Medicine (JPTM), a multi-institutional program encompassing all transfusion medicine activities at the BWH, DFCI and CHB. The BWH/DFCI service performs approximately 100,000 tests, and issues 67,000 blood products per year. Currently, the Kraft Donor Center collects approximately 7,000 single donor platelet units/year, and the BWH Donor Center collects approximately 4400 volunteer and 2000 autologous RBC units/year.

Thus, the Clinical Laboratories include:
- Clinical Chemistry: **Dr. Petr Jarolim**
- Clinical Microbiology: **Dr. Andrew Onderdonk**
- Hematology: **Dr. David Dorfman**
- Blood Bank/Transfusion Medicine: **Dr. Richard Kaufman**.
There are specialty laboratories in:
Endocrine-Hypertension: Dr. Vincent Ricchiuti
Immunology: Dr. Peter Schur
Reproductive Endocrinology: Dr. George Mutter
Tissue Typing: Dr. Edgar Milford
Virology: Dr. Frederick Wang

Dr. David Dorfman is the Associate Director of the Clinical Laboratories Division.

Advanced Molecular Diagnostics

In 2011, the Center for Advanced Molecular Diagnostics analyzed 8,184 Cytogenetics specimens and 16,732 Molecular Diagnostics tests. Dr. Neal Lindeman and Dr. Cynthia Morton are the Co-Directors of the Center for Advanced Molecular Diagnostics, for Molecular Diagnostics and Cytogenetics, respectively.

Departmental Facilities

The hub of the Pathology Department is in the Amory second/third floor complex in BWH, recently augmented by space in the new Shapiro Cardiovascular Building. The Anatomic Pathology laboratories and offices occupy contiguous space on the third floor of the Amory Laboratory Building, and the 3rd and 7th floors of the adjacent Medical Research Building. The Clinical Laboratories are located primarily on the second floor of the Amory Lab Building. Additional space is functionally related to the multiple components that comprise multicentric distributed campus model of in-patient and out-patient care, encompassing Clinical Laboratories at 850 Boylston St., multiple community-based health centers with point-of-care capabilities (Brookside Community Health Center, and the Southern Jamaica Plain Health Center), and the newly-opened Brigham and Women's/Mass General Health Care Center at Foxborough (with out-patient laboratories and frozen section capabilities for day surgery).

The BWH Department of Pathology has recently completed a long-planned renovation project to re-engineer the workspace for clinical and educational activities. The results include efficiencies in specimen workflow and modern information technology in Surgical Pathology (e.g., specimen barcoding), robotic, automated systems in the Clinical Laboratories, and a new state-of-the-art Ramzi Cotran Conference Center. Concurrently, the Center for Advanced Molecular Diagnostics has launched new programs to transform the role of Pathology in the context of Personalized Medicine.
Research Programs

Investigation of the pathophysiologic mechanisms and manifestations of human disease is a defining feature of our Department. Indeed, we are one of the nation’s most research-intensive academic pathology departments. The Faculty is a highly committed and accomplished group of basic, translational, and clinical investigative pathologists with expertise spanning a broad range of scientific approaches in anatomical and clinical pathology subspecialties.

Areas of research emphasis include vascular biology/cardiovascular pathology, cellular and molecular immunology, translational cancer pathology, molecular genetics, molecular hematopathology, neurodegeneration, pulmonary pathobiology, structural molecular pathology, and dermatopathology. Translational research emphases include the application of cutting edge analytical, genomic, proteomic and imaging technologies to identify and exploit molecular targets for the diagnosis and therapeutic treatment of human cancers and cardiovascular disease. As but one example, the Center for Molecular Oncologic Pathology (CMOP), a joint DFCI-BWH Laboratory for Translational Molecular Pathology, focuses on disease-related basic and translational research and provides the Center for Advanced Molecular Diagnostics (CAMD) identifying promising targets for molecular tests to enhance diagnosis and treatment. CMOP is committed to translating the discoveries made in cancer pathobiology and genetics into improvements in cancer diagnosis and treatment. This Center provides a collaborative environment for oncologic, pathology-based, hypothesis-driven research, where pathologists work together with basic scientists, and translational and clinical researchers to develop molecular pathology technologies and resources to support targeted cancer therapy. It is also emblematic of the tripartite mission of the BWH Department of Pathology; our research activities enrich and inform our clinical, educational, and investigative domains. Our embrace of research activities is also reflected by the backgrounds and career aspirations of our residency and fellowship trainees, many of whom begin their training (clinical, pre- and post-doctoral) with significant previous experience and/or formal research training. There is an extremely vibrant cohort of clinical and translational research activities being conducted primarily by clinical faculty. Finally, and perhaps most importantly, this focus is made viable by the Department’s commitment to providing a nurturing environment and enabling infrastructure for the conduct of a broad spectrum of investigative activities.

The FY2012 Departmental sponsored research funding portfolio includes:

- over 40 investigator-initiated NIH R01 or equivalent awards
- four invitational awards (Burroughs Wellcome Fund, Mary K. Ash Foundation, V Foundation)
- 15 NIH K08 or equivalent individual fellowship and mentored career development and awards (the Department has a near-perfect record of successful K award applications in the past decade)
- one Institutional National Research Service Award (T32) continuously funded by NIH since 1958. This Training Grant currently funds 12 trainees per year and has a very successful record in supporting the research training of clinician-scientists.
In addition, the Department-based Program Projects include:
- an NHLBI-sponsored Program Project (P01) in Endothelial Pathophysiology
- an NCI-Sponsored Program Project (P01) in Oncogenic NOTCH Signaling
- an NHGRI-sponsored special resource program (R41) investigating the copy number variation in the human genome
- a Specialized Center of Research program funded by the Leukemia and Lymphoma Society investigating Notch Pathway Inhibitors and Enhancers

The Faculty has forged significant funded collaborations throughout the greater Harvard academic community to include the investigations with Dana-Farber Cancer Center, Broad Institute of MIT and Harvard, Children’s Hospital Boston, Harvard Digestive Disease Center and the Harvard Stem Cell Institute. Currently active collaborations include the leadership of an 37 multi-investigator projects and/or inter-institutional Cores comprised of 28 Program Project (P01) programs; six NCI-SPORE programs (P50) in Renal, Prostate, Skin, Gastrointestinal, Ovarian and Breast Cancer; the 1000 Genomes Project; Lymphoma Molecular Target testing Core; and the Gnotobiotic Mouse Core. In recent years, BWH Pathology investigators have received peer-reviewed research and training awards totaling more than $18 million in direct costs annually— a total comparable to a ranking within the top 10% of U.S. medical school Departments of Pathology.

The Department of Pathology also provides the leadership, space, and sustaining financial support for specialized analytical technologies and cores essential for collaborative molecular investigations that accelerate the translation of scientific discoveries into novel diagnostic or potentially therapeutic applications. Our Department Faculty are leading the NIH-funded Informatics for Integrating Biology Center (i2b2) that is developing a Partners Healthcare-wide scalable informatics framework enabling clinical researchers to use existing clinical datasets for discovery research. When combined with IRB-approved genomic data, these resources facilitate the design of targeted therapies for individual patients with diseases of genetic origins.

Also within the Department are a number of state-of-the-art research core facilities. The Dana-Farber Harvard Cancer Center has designated five core facilities in the BWH Pathology Department:
- Specialized Histopathology Services
- Tissue Microarray Core
- Cytogenetics Core, Virtual Specimen Locator Core
- Lung SPORE Pathology Core
- Renal SPORE Pathology Core

Other shared facilities and resources that enrich the research environment and provide powerful tools for research include: Laser-capture/microdissection microscopy, multi-fluorescence in situ hybridization, flow cytometry, transcriptional bioinformatics, vascular cell isolation, confocal microscopy, transcriptional bioinformatics, the Cardiovascular Biomarker Research Facility, the acquisition and stewardship of highly annotated clinical specimens for research through the new Personalized Cancer Medicine Partnership, and the Cardiovascular, Diabetes and Metabolic Disorders Human Tissue Repository.
Residents and Clinical Fellows are encouraged to participate in research rotations under the supervision of a faculty mentor to develop an understanding of experimental design strategies and advanced methodologies necessary to conduct research projects in their scientific field of interest. Approximately half of the BWH Pathology Residents subsequently elect to pursue an individually-tailored in-depth mentored basic- or translational research fellowship after the two- or three years of clinical training in preparation for pursuing various research-related career paths in clinical practice, academia, and industry. To facilitate this process, residents are exposed to the many research investigations underway in the department through numerous conferences, seminar series, and journal clubs. Likewise, Pathology residents can take advantage of being situated within the larger biomedical research environment of the greater Longwood Medical area and other research resources of the greater Harvard Community, including the Broad Institute, the Harvard Stem Cell Institute, and the Harvard Wyss Institute for Biologically-Inspired Engineering. Pathology Residents at Brigham and Women's Hospital often elect to pursue an individually tailored in-depth mentored basic or translational research fellowship after the two or three years of clinical training in preparation for pursuing various research-related career paths in clinical practice, academia, and industry.

The Department of Pathology at the Brigham & Women’s Hospital is committed to the concept of translational molecular pathology — the fundamental investigation of disease mechanisms and pathogenesis and the translation of this new knowledge to the better detection and treatment of the full spectrum of human diseases through development and implementation of innovative “cutting-edge” technologies, particularly in Molecular Diagnostics and Cytogenetics. Brigham & Women’s Hospital took a major step in the practical implementation of this strategy through the creation of the Center for Advanced Molecular Diagnostics (CAMD) in the Shapiro Center at 70 Francis Street. This facility houses Faculty with backgrounds covering a wide range of medical disciplines (e.g., cancer, infection, genetics, immunology, bioinformatics, etc.) and expertise in translation of scientific discovery into clinical laboratory practice, appropriate technical staff, and the most sophisticated new instrumentation currently available. This state-of-the-art facility provides a physical home for our burgeoning Divisions of Molecular Cytogenetics and Molecular Diagnostics, components of Molecular Cytology and Surgical Pathology, and the new Crimson Biospecimen Banking Project. Through its collaborations with other BWH, MGH, and Partners’ initiatives (e.g., Donald W. Reynolds Cardiovascular Clinical Research Center, the Harvard/Partners Center for Genetics and Genomics Laboratory for Molecular Medicine, collaborations with The Broad Institute, and others), the CAMD provides the BWH with its own “Bridge to Personalized Medicine”.

Moreover, these resources provide an opportunity for residents and fellows to participate in translation of scientific discovery into clinical practice. Residents and fellows have helped this center to bring new assays (e.g., EGFR mutation analysis in lung cancer, JAK2 mutation analysis in myeloproliferative neoplasms, MGMT promoter hypermethylation in glioma) into real-world clinical practice. Residents and Fellows may participate in several capacities, to an extent commensurate with their interest and experience. They have contributed directly at the bench, have supervised technologists working on test development and data analysis, and have helped to communicate the proper use and interpretation of new tests with other pathologists and interested clinicians, in our institution and beyond. These experiences are available to trainees as a brief one-week introductory rotation, an in-depth three-month elective, or a year-long ACGME-accredited fellowship in Molecular Genetic Pathology. These
initiatives in translational biology provide a deep experience for our residents that transcend conventional training in histopathology and lab test interpretation—even for trainees who choose to never set foot in the CAMD. Molecular pathology is woven into the fabric of the BWH Department of Pathology, and is integrated routinely into weekly conferences, daily signouts, and casual conversations over coffee.

Several additional aspects of the BWH Department of Pathology of importance to the residency program and its trainees deserve emphasis. For example:

- Adoption of “Translational Molecular Pathology” as a Department-wide organizing principle provides a forward-looking dimension to the various subspecialties of both Anatomic and Clinical Pathology, and bridges traditionally discrete “silos”.

- Our trainees and faculty give a large number of poster and platform presentations at national and international scientific and clinical meetings. Indeed—emblematic of the Departmental productivity—BWH Pathology has ranked in the top three departments in the country for first author platform presentations at the annual USCAP meeting by Trainees and Junior Faculty for each of the last five years.

- Members of our senior faculty have a significant and sustained commitment to curricular design and implementation in undergraduate medical education at HMS, spanning both the “New Pathway” and the Harvard-MIT Health Sciences and Technology (HST) curricula.

- Department Faculty also feature prominently in the educational programs of national Pathology organizations, such as the United States and Canadian Academy of Pathology (USCAP), the College of American Pathologists (CAP), and the American Society for Investigative Pathology (ASIP).
Clinical Fellowship Programs

The BWH Pathology Department offers a broad diversity of intensive subspecialty pathology experiences including ACGME-accredited fellowships in:

- Blood Banking/Transfusion Medicine (involving BWH, Children’s Hospital Boston, Dana-Farber Cancer Institute, MGH and Beth Israel Deaconess Medical Center)
- Cytogenetics
- Cytopathology
- Dermatopathology (BWH, MGH, Beth Israel Deaconess Medical Center and VA Hospital)
- Hematopathology (BWH, Children’s Hospital, and Dana-Farber Cancer Institute)
- Molecular Genetic Pathology (BWH, MGH, Dana-Farber Cancer Institute, Children’s Hospital and Beth Israel Deaconess Medical Center)
- Neuropathology (BWH, Children’s Hospital Boston and Beth Israel Deaconess Medical Center)
- Pediatric Pathology (at Children’s Hospital Boston)
- Women’s and Perinatal Pathology

The Dermatopathology and Molecular Genetic Pathology (MGP) training programs are collaborative among all Harvard teaching hospitals. A Pathology Information Technology (IT) Fellowship collaborative with MGH has recently been established. Indeed, the IT and MGP programs constitute “bridging activities” that span not only multiple institutions but also multiple traditional pathology subspecialties. High-quality non-accredited fellowships are also available in most pathology subspecialties; examples include:

- Breast Pathology
- Cardiovascular Pathology
- Gastrointestinal Pathology
- Genitourinary Pathology
- Medical Microbiology
- Pulmonary Pathology
- Corson Thoracic Pathology Fellowship
- Renal Pathology
- Soft Tissue Pathology
- Surgical Pathology

Fellows have greater responsibility and independence than residents in terms of working up cases and interacting with clinicians, with supervision by subspecialty faculty members. Fellows play a key role in the orientation, training and supervision of residents, thereby gaining an additional form of graduated responsibility. Care is taken, however, that fellows augment but do not interfere with the learning opportunities of residents.
RESIDENCY PROGRAM STRUCTURE

GENERAL FEATURES

The residency program is available as either a three-year program in Anatomic Pathology (AP), a three-year program in Clinical Pathology (CP), or a combined four-year program in both Anatomic and Clinical Pathology (AP/CP). All trainees seeking AP alone or AP/CP first complete the two-year Core AP program consisting of a broad mix of surgical and autopsy pathology and cytopathology, plus elective subspecialty rotations. All trainees seeking CP alone or AP/CP complete a 15-month Core CP program consisting of rotations in Chemistry, Microbiology, Transfusion Medicine, and Hematology and Molecular Diagnostics. Senior residents in any of the three tracks choose from a broad array of advanced subspecialty rotations, research, and/or leadership positions such as Chief Resident. To complement all of these rotations, there is an extensive and well-organized schedule of both working and teaching conferences in which residents at all levels participate.

Individualized programs are designed in conjunction with each resident trainee prior to each academic year, with consideration given to level of training, individual preferences, long-term goals, and Board requirements. Trainees in good standing are guaranteed funding through completion of the training requirements of the American Board of Pathology, plus at least an additional year of clinical or research training. Many Residents do multiple pathology subspecialty fellowships or a combination of subspecialty and research training. The majority of residents enter the Program with interests in academic and research careers, and most assume productive careers in academic centers; however, a subset become practicing pathologists in the community. Thus, Brigham and Women’s Hospital provides a strong core program in diagnostic pathology with in-depth training in subspecialties and research.

Senior residents assume increased diagnostic, teaching, and administrative responsibilities on autopsy, surgical pathology and laboratory services, with appropriate senior staff supervision. Senior residents in any of the three tracks choose from a broad array of advanced subspecialty rotations, research, and some are selected for leadership positions such as Chief Resident and Senior Resident in Surgical Pathology. In accordance with requirements of the ACGME (the principal accrediting agency for residency programs nationally), competency-based training and evaluation are emphasized.

The Residency Training Programs have consistently received highly favorable reviews by the Residency Review Committees. The AP/CP program most recently (2009) obtained continued full accreditation for 5 years and was commended for a higher than average pass rate on the Pathology Board Examinations.
ANATOMIC PATHOLOGY TRAINING PROGRAM

The Core AP Program comprises 24 months total; it consists of approximately:
- 3 months of autopsy pathology
- 8 months of general surgical pathology
- 4 months in the Women's and Perinatal Division for gynecologic/obstetrical pathology
- 4 weeks at the Children's Hospital for pediatric pathology
- separate 1-3 month rotations in hematopathology, cytopathology, dermatopathology and neuropathology
- 2 weeks forensic pathology
- experience in molecular diagnostics/cytogenetics, renal pathology, breast pathology
- 2-3 weeks of independent study/subspecialty electives each year.

Following the Core program and beginning in the third year, the training is individualized. Experiences from 3-6 months in duration to fellowships comprising a year (or longer) are available in:
- general surgical pathology
- hematopathology
- cytopathology
- neuropathology
- soft tissue pathology,
- pediatric pathology
- cardiovascular pathology
- dermatopathology
- pulmonary pathology
- gastrointestinal pathology
- women's and perinatal pathology
- breast pathology
- urologic pathology
- renal pathology
- cytogenetics
- molecular genetic pathology

For those combining AP with subspecialty or research training, periods of full time laboratory research or full time clinical service in a subspecialty, or both, follow and supplement the Core program. Clinical research opportunities are abundant throughout the training experience. Extensive basic and translational research opportunities are available within the Department of Pathology and elsewhere in the Longwood Medical Area.
The Core CP training for AP/CP or first-year CP Residents comprises 15 months and consists of 3-month rotations in Clinical Chemistry, Microbiology, Transfusion Medicine/Blood Bank, Hematology and Molecular Diagnostics.

Following the Core program and beginning in the second year for CP Residents, the training is individually tailored to meet each resident's specific career goals, and include a customized combination of electives, advanced core rotations, service as Chief Resident, and research. For AP/CP Residents, at least six additional months of training are spent in elective rotations such as molecular diagnostics, cytogenetics, or informatics, service as Chief Resident, and/or advanced rotations in any of the core or subspecialty laboratories.

**SAMPLE SCHEDULES:**

Representative schedules of an entire program for combined AP/CP, straight AP (Academic/Subspecialty), straight AP (Research), and straight CP appear below.

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### REPRESENTATIVE AP ONLY (ANATOMIC/SUBSPECIALTY) RESIDENCY ROTATION SCHEDULE

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<td>Senior AP rotations (breast, cardiac, dermatopathology, endocrine, gastrointestinal, genitourinary, gynecologic, head and neck, hematopathology, molecular diagnostics, neuropathology, pulmonary, renal, and soft tissue pathology)</td>
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### REPRESENTATIVE AP ONLY (RESEARCH) RESIDENCY ROTATION SCHEDULE

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### REPRESENTATIVE CP ONLY RESIDENCY ROTATION SCHEDULE

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DESCRIPTION OF ANATOMIC PATHOLOGY ROTATIONS

Surgical pathology and subspecialties comprise at least 14-16 months of the core experience. This is accomplished either as integrated/longitudinal exposure to general surgical pathology and some subspecialties (e.g. breast pathology, gastrointestinal pathology, cardiovascular pathology, pulmonary pathology, genitourinary pathology, soft tissue pathology) or as dedicated subspecialty rotations in others (e.g. women’s and perinatal pathology, neuropathology, dermatopathology, hematopathology, pediatric pathology). Other major rotations include cytopathology and autopsy pathology.

A typical first year comprises approximately 5 months of general surgical pathology, 2 months of women's and perinatal pathology, 3 weeks of dermatopathology, 1-2 months of autopsy pathology, 4 weeks cytopathology, 2 weeks elective (usually neuropathology, hematopathology, renal pathology, cardiac/pulmonary or clinical pathology), and 2 weeks of molecular diagnostics/cytogenetics and independent study. A typical second year comprises approximately 3 months of general surgical pathology, 1 month of women's and perinatal pathology, 1 month of autopsy pathology, 2 weeks of independent study, and the remainder divided among rotations at the Children’s Hospital, the Medical Examiner's Office, hematopathology, neuropathology, cytopathology, and dermatopathology.

GENERAL SURGICAL PATHOLOGY AND INTEGRATED SUBSPECIALTIES

Supervisor: Christopher D.M. Fletcher, M.D.
Duration: 8 months total in core (supplemented by dedicated rotations in Women’s and Perinatal Pathology, Dermatopathology, Hematopathology, Neuropathology, and Pediatric Pathology)

Goals and Objectives:

- To provide a high-volume and active learning environment in which residents develop key competencies in diagnostic pathology
- To educate residents in the knowledge, skills and attitudes needed for pathology practice
- To develop consultative, administrative, and managerial skills needed to convey a diagnosis to the clinician after interpretation of a biopsy or resection

GENERAL SURGICAL PATHOLOGY ROTATIONS

Detailed descriptions of the rotations in surgical pathology, methods for processing, interpreting and reporting individual specimens, and the logistics of each of the various subdivisions of the service are provided in a detailed two-volume Surgical Pathology Manual, updated annually. Six residents are typically on the surgical pathology service at one time. The work is divided broadly into diagnostic biopsy specimens (“Quicks”), therapeutic resection specimens (“Bigs”), GI biopsies, frozen sections, and slide consultations. General surgical pathology cases, including endocrine, mediastinal, pulmonary, urinary tract, male genital tract, bone and soft tissue specimens as well as GI resections, are seen by the general surgical pathology resident rotating on surgical pathology and are signed out with the general staff. During first and second year 4-6 week rotations, hematopathology, cytology,
neuropathology, gynecologic, cardiac, GI, and dermatopathology cases are processed and reviewed by residents and signed out with the senior subspecialty pathologist. Beginning residents are trained in specimen dissection, frozen section and section preview, and supervised on a one-on-one basis by educated senior resident preceptors for 2 weeks at the start of their first surgical pathology rotations. Senior residents, fellows and staff are readily available for consultation thereafter.

While on the Surgical Pathology service, a resident rotates between cutting in and signing out. Typically, a resident will cut in his/her specimens one afternoon, receive his/her slides back the next day, examine them that afternoon/evening and formulate a written diagnosis, and sign them out with the senior pathologist the following day. The opportunity to review slides and develop an independent diagnostic opinion prior to one-on-one sign-out with faculty is a key element of our training program. A resident rotating on the general surgical pathology service is quite busy; on a typical afternoon, a resident may process as many as 50 cases with the help of pathology assistants.

On the Frozen Section Service, residents perform operating room consultations in order to become competent in frozen section diagnosis and in preparing frozen sections. A resident covers the Frozen Section Service from 7:30 am to 7:30 pm. with a senior staff member. Technicians are in the laboratory from 8:30 am to 5:00 pm weekdays and on an "on-call" basis from the main laboratory from 8 am until noon on Saturday. The Frozen Section Service processes approximately 40 specimens per day. The resident is responsible for the gross description, recording, and preparation of any special studies, and selection of samples for frozen sections or other special studies in consultation with the staff pathologist. The resident examines the slides with the staff member, formulates a diagnosis, and as he/she becomes more senior, communicates that diagnosis to the surgeon. Many specimens come to this laboratory for gross examination only and for evaluation of tissue allocation to research studies (according to IRB-approved protocols), in which the resident also participates. Second-year residents on sub-specialty rotations are responsible for all operating room consultations from 7:30 pm to 7:30 am on weekdays. Weekend frozen section coverage is provided by the resident on surgical pathology (days) and second-year residents on-call (nights).

Residents progressively gain the appropriate competencies and confidence as they ascend along a steep learning curve in surgical pathology. During preparation for sign-out, they have ready access to surgical pathology and subspecialty pathology texts in a specifically designated mini-library within the residents' review room. Teaching on the service is extensive. In addition to a one-on-one learning experience with staff at daily sign-out conferences, Residents participate actively in multiple conferences ranging from the interesting case conference held weekly to weekly dermatopathology and oncology conferences. A slide conference is devoted specifically to resident education in specific surgical pathology topics and follows a systematic curriculum through the year; a Surgical Pathology Update each week provides an overview presentation by a BWH or other Faculty expert on a contemporary topic. Residents also participate in a variety of other surgical pathology-oriented conferences under the various subspecialties. Residents are encouraged to publish appropriate material encountered (or other clinical research projects involving archived specimens) during their time in surgical pathology with the help of senior staff.

As advanced residents progress and gain competence through the program, they attain
increasing responsibility and:

- Sign out frozen sections with staff supervision.
- Sign out of quikcs/bigs surgical specimens with staff supervision.
- Serve as preceptor as a second/third year resident training first year residents in procedures and gross and microscopic pathology.
- Represent the department by presenting and discussing cases in conferences with the departments of Radiology, Medicine, Oncology, Hematology, Surgery and others.
- Give seminars/lectures/reports of studies performed to pathology residents and staff.

There is considerable resident (and fellow) involvement in consultations. Functioning as consultants to other physicians, residents respond to calls from clinicians, provide results of early readings, and give final diagnoses.

**Surgical Immunopathology**

Immunopathology exposure is longitudinal, as immunopathological techniques are used routinely in surgical pathology and in most of the subspecialties:

(a) Immunohistochemical studies are requested by residents following consultation with the senior staff. The slides from these studies are then reviewed with the residents in regard to interpretation of the markers, their diagnostic applicability in a given case, and their incorporation into the case signout.

(b) For hematopathology cases, residents are provided with the cryostat and paraffin sections studies on lymphoid tissues, bone marrows, and other hematologic specimens. In some cases, flow cytometry studies are also available. The residents are responsible for interpretation of this material and incorporation of the findings in the case signout. The routine sections and the immunophenotypic studies are then reviewed with the senior staff in preparation of the final report.

(c) During rotations in dermatopathology, residents are instructed in the interpretation of immunofluorescence studies as they relate to the evaluation of bullous diseases, connective tissue diseases, vasculitis and other disorders. Residents are also instructed in the use of immunoperoxidase studies in the assessment of leukemic or lymphomatous skin infiltrates and in the evaluation of various neoplasms.

(d) In renal pathology, residents learn to interpret immunofluorescent studies of renal biopsies to determine sites of reactivity and patterns of deposition of immunoglobulins, complement, fibrinogen, and albumin, as they relate to various diseases, e.g., glomerulopathies, collagen diseases, coagulopathies, vasculitides, and other disorders. The residents are further instructed in the correlation of these studies with histologic features and electron microscopy, as well as the clinical findings, in order to arrive at a final interpretation of the renal biopsy.

(e) In cytology, immunohistochemical studies are performed on cytocentrifuge preparations, cytologic smears, and/or cell blocks in evaluation of possible lymphomatous processes and assessment of specific tumor types. Residents are provided with this material and are instructed in the incorporation of these studies in
Electron Microscopy

An active diagnostic electron microscopy (EM) service, handling > 800 cases per year, is established in the Department. The vast majority of specimens handled are renal biopsies (under the supervision of Dr. Helmut Rennke), with a much smaller number of unusual tumors (under the supervision of Dr. Christopher Fletcher), the latter consisting principally of poorly differentiated neoplasms identified at frozen section, soft tissue tumors, and pleural tumors, especially mesothelioma. An additional group consists of nerve, muscle and brain biopsies, mainly for non-neoplastic disorders. The purpose and role of electron microscopy (as well as the appropriate manner to handle specimens for ultrastructural analysis) is explained to residents early in their training and is described in the Manual of Surgical Pathology. The majority of EM cases are signed out by Drs. Rennke or Fletcher, except for pleural lesions which are reported by Dr. Joseph Corson. Neuropathology cases are signed out by the attending faculty on that service, having first been evaluated by the neuropathology fellow. An attempt is always made to show, discuss, and explain the EM findings with the relevant resident or fellow handling the case and the EM photomicrographs are also made available to the regular attending who is handling the case so that the results may be discussed at final signout of the entire specimen.

In addition, aside from any EM component in organ-specific lectures or seminars, occasional teaching (or surgical pathology) conferences are devoted to the use of electron microscopy and its interpretation. Residents who show a particular interest are taught and encouraged to take part in the routine electron microscopy (including viewing, photographing and writing the report for cases), usually while doing renal pathology. Several residents have also incorporated an EM component in their research projects.
**BREAST PATHOLOGY**

**Supervisor:** Susan Lester, M.D., Ph.D.

**Duration:** Integrated longitudinally with surgical pathology rotation in core and available as a 1 to 12 month elective

**Goals and Objectives:**

- To gain experience and expertise in difficult areas in breast pathology (ADH vs DCIS, DCIS vs LCIS, sclerosing lesions vs invasive carcinoma, papillary lesions, etc.).
- To be able to determine and accurately report prognostic/predictive factors in breast cancer and to understand how this information is used to guide patient management (e.g. AJCC T and N classifications, lymphovascular invasion, grade).
- To be able to interpret ancillary studies, e.g. immunoperoxidase studies for ER, PR, and HER2/neu, FISH for HER2/neu.
- To interpret image guided core needle biopsies and to be able to correlate the pathologic findings with the radiologic findings.
- To be able to evaluate breast specimens after neoadjuvant chemotherapy and to classify pathologic response using current systems (e.g. Miller-Payne and Residual Cancer Burden).
- To become involved in projects to enhance the care of patients with breast cancer.

Residents will obtain extensive experience in interpreting breast lesions in excisions performed at BWH during the core rotations in surgical pathology.

The Breast Pathology Service signs out all breast pathology consultations (over 2200 cases per year), all core needle biopsies of the breast (over 1100 per year), and all immunoperoxidase studies on breast cancers. The service is also available for consultation for difficult breast lesions excised at BWH. Teaching sets are available in basic breast pathology, histologic types of breast cancer, hyperplasia/ADH/DCIS, core needle biopsy interpretation, inflammatory breast diseases, stromal lesions of the breast, and evaluation of breast carcinomas after neoadjuvant chemotherapy.

The advanced resident/fellow has the following responsibilities:

- Review and sign-out all breast pathology consultations, breast core needle biopsies, and all in-house consultations in collaboration with the breast pathology senior staff.
- Present interesting current clinical cases (usually 2 to 30) to a multidisciplinary team (surgeons, medical oncologists, and radiation oncologists) once a week; cases are presented from glass slides using a microscope and projector.
- Interpret and report immunoperoxidase studies on breast cancers.
- Attend the every other week breast core needle pathology/radiology conference. Cores with interesting findings or with management issues from the prior month are reviewed and correlated with the radiologic findings.

Residents and fellows should attend the weekly Breast Center conferences when the topic is of interest to pathologists.
Cardiovascular Pathology

Supervisors: Gayle L. Winters, M.D., Richard Mitchell, M.D., Ph.D., Robert Padera, M.D., Ph.D. and Frederick Schoen M.D., Ph.D.

Duration: Integrated longitudinally with surgical pathology rotation in core and also available as 1-2 week first year elective and 3 month to 1 year advanced elective/fellowship

Objective:

To gain familiarity with diagnostic considerations in cardiovascular surgical pathology and increase general knowledge of cardiac and vascular pathology.

To accomplish the goal, the resident will:

- Preview and provide diagnoses for the rush endomyocardial biopsies and sign out other cardiovascular surgical pathology with the designated senior cardiac pathologist
- Perform diagnostic evaluation of all cardiac valves, explanted hearts, and large vessels

In addition, residents on an elective rotation dedicated to cardiovascular pathology will:

- Teach in various courses and conference opportunities involving cardiovascular pathology
- Review a brief teaching slide set of biopsy specimens with a staff member upon joining the rotation. Subsequently, review a formal teaching set of other cardiac and vascular pathology
- Review all cardiac and vascular pathology on the Autopsy Service arising during the period
- Review a notebook of key reprints
- Review specimens in the cardiac pathology museum collection in the autopsy room, as interested, and with coordinated staff review, as necessary
- Review and provide diagnoses for a self-assessment teaching slide set during the last week of the rotation, and review those with a cardiac pathology staff member

Residents are closely supervised by Drs. Gayle Winters (Director of Cardiac Pathology), Richard Mitchell, and Robert Padera. Research interests of the group include ischemic, myocardial and valvular pathology, substitute valves and other prosthetic devices, transplantation pathology, and immunopathology. Opportunities exist for residents to elect additional advanced rotations in cardiovascular pathology, in order to pursue specific projects or develop areas of interest.

The Cardiovascular Pathology Division provides support for an active cardiac transplant service through the interpretation of more than 600 endomyocardial biopsies and the evaluation of approximately 25 explanted hearts per year. In addition, several hundred removed native and prosthetic valves, aortic segments and cardiac tumors are received as surgical specimens and many autopsies on patients with cardiac diseases (with and without prior surgical and interventional treatment) are done annually. Surgical pathology specimens and autopsy hearts are frequently received in consultation from other institutions.
**Gastrointestinal, Hepatic, and Pancreaticobiliary Pathology**

**Supervisor:** Robert D. Odze, M.D., FRCP C  
**Duration:** Integrated longitudinally with surgical pathology rotation in core and available as a 1-6 months advanced elective or 1 year fellowship

**Goals and Objectives:**

Experience in Gastrointestinal, Hepatic, and Pancreaticobiliary Pathology is obtained as a component of the core rotations in surgical pathology. Senior residents can select to participate on this service for periods ranging from 1-6 months (or 1 year as a fellow). As junior residents, experience with this service comes from "GI" signouts, since GI and liver biopsies represent a large component of specimens processed through the "quicks" bench. The objectives of this rotation are to:

- Develop competency in diagnosing GI, liver and pancreaticobiliary diseases by analysis of biopsy specimens and resection specimens and understanding the objectives and information to be obtained from analysis of biopsy specimens.
- Develop competency in interacting with clinicians and consolidating clinico-pathological data.
- Stimulate interest in performing clinico-pathologic research related to GI, liver, or pancreaticobiliary diseases.

The Gastrointestinal Pathology Service handles approximately 30-60% of the specimens coming through the general surgical pathology service, actively interacts with the clinical gastroenterologists at the institution, participates in several academic GI and Liver conferences in the Harvard Medical area, and conducts a broad range of investigative and surgical pathology research activities.

The service is headed by Dr. Robert Odze, and typically involves 2 fellows. Residents and Fellows are encouraged to participate in clinical GI, liver or pancreaticobiliary research projects which include surgical pathology research related to Barrett's esophagus and other GI inflammatory, metaplastic and neoplastic disorders, intestinal dysplasia, inflammatory bowel disease and gastrointestinal polyposis syndromes.
**PULMONARY AND PLEURAL PATHOLOGY**

**Supervisor:** John Godleski, M.D.

**Duration:** Integrated longitudinally into core and available as 1 -12 months advanced elective.

**Goals and Objectives:**

This rotation provides the opportunity to develop diagnostic acumen in neoplastic and non-neoplastic pulmonary and pleural diseases. Approximately 500 patients receive surgical treatment for lung cancer and over 150 undergo pleurectomy or extrapleural pneumonectomy for mesothelioma at BWH each year. Thus, as part of the core training, first and second year residents gain extensive exposure to neoplastic thoracic disease and its clinical management in the frozen section room, on the grossing bench and under the microscope. In addition, the majority of advanced lung tumors undergo molecular analysis, and the resident often assists at the interface between the clinicians and molecular geneticists. Through exposure to the busy DFCI consultation practice (approximately 500 neoplastic lung and pleural consult cases reviewed here each year), a senior resident or fellow on the rotation is expected to develop a more sophisticated understanding of the current diagnostic and staging guidelines and knowledge of the important molecular alterations in lung cancer.

The BWH Interstitial Lung Disease Clinic attracts patients with a variety of non-neoplastic lung diseases, and the active pulmonary transplant service (20-30 lung transplants performed per year) ensures that the senior resident or fellow reviews on average 3-5 transbronchial biopsies per week for transplant rejection surveillance. The rotating resident should become comfortable with the manifestations and grading of acute and chronic lung transplant rejection, with the major forms of intersitial and fibrosing lung diseases, as well as the diagnosis of common pulmonary infections including mycobacterial, fungal, and bacterial diseases.

**Responsibilities of an advanced resident/fellow:**

- Previewing of all consultation cases (DFCI and BWH) and coordinating to retrieve additional materials from referring institutions as needed for diagnosis.
- Daily sign out of mesothelioma and neoplastic and non-neoplastic lung cases.
- Assistance in the orientation and sampling of complicated thoracic surgical resection specimens performed at BWH.
- Preparation of the pathology discussion for the weekly Joint Thoracic Surgery-Radiology-Pathology Conference held every Wednesday at 7:15 am and for the weekly Interstitial Lung Disease Multidisciplinary Conference held Tuesdays at 3:00 pm.
- Clinical case review with the pulmonary, transplant, and infectious disease teams (4pm, daily).
- Fellows are expected to engage in a research project pertaining to some area of lung or pleural disease that will advance our understanding of the biology and/or diagnosis of neoplastic or non-neoplastic disease.

The BWH staff members who sign out on this service include: Joseph Corson, M.D., John Godleski, M.D., Les Kobzik, M.D., Robert Padera, M.D., Ph.D., Lucian Chirieac, M.D., Sara Vargas, M.D., and Lynette Sholl, M.D.
RENAL PATHOLOGY ROTATION

Supervisor: Helmut G. Rennke, M.D.
Duration: Available as 3 months – 1 year advanced elective/fellowship

Goals and Objectives:

- To review the pathological features of the most important and common renal disorders and acquire the ability to diagnose them.
- To experience the nature and dynamics of an academic renal pathology service.
- To learn essential principles of the ancillary techniques used in the evaluation of the renal biopsy.

Under the direction of Dr. Helmut Rennke, the resident will participate in all the daily activities of the renal pathology laboratory and will be involved with the renal staff pathologist in all the steps leading to the final diagnosis of all renal specimens submitted, including consults. These steps involve the examination of the fresh tissue obtained in the ultrasound suite, using the stereomicroscope, evaluation of the suitability of the tissue for structural analysis, dividing the tissue for immunofluorescence, light, and electron microscopy, reading the results, and reporting the findings. Self-teaching material, consisting of sets of carefully selected illustrative cases, composed of slides, immunofluorescence microscopy illustrations, electron micrographs and clinical histories will be available. A pertinent list of reading material will be provided. Groups of cases will be discussed and reviewed on the multiheaded microscope.

During this period, the resident should also become familiar with the use of the immunofluorescence and electron microscopy techniques used in the evaluation of renal biopsies, including processing of the tissue, operating the electron microscope, morphometric principles and the evaluation of the basement membrane thickness, calculation of final magnifications on micrographs, etc.

Conferences and other learning opportunities:

Renal Grand Rounds: one teaching case (often with pathology) is presented followed by a didactic talk (Renal Division).

Review of current cases with staff nephrologists, nephrology fellows, and house staff; every day at 4:00 pm at the multiheaded microscope (Pathology Department).

Journal Club of the Renal Division
**SOFT TISSUE PATHOLOGY**

**Supervisor:** Christopher D.M. Fletcher, M.D.

**Duration:** Integrated longitudinally in core and available as 1-6 months advanced elective

**Goals and Objectives:**

- To develop and expand diagnostic skills in soft tissue and oncologic pathology.
- To understand and experience the central role of close clinicopathologic collaboration in surgical oncology.
- To undertake one or more research projects in the field of soft tissue neoplasia.

Experience in Soft Tissue Pathology is obtained as a component of the core rotations in surgical pathology. However, specialized training in the pathology of soft tissue tumors and related oncologic pathology as advanced rotations during the 3rd or 4th years of residency, comprising periods of 3-6 months or a year or more may be done under the close supervision of Dr. Christopher Fletcher, Director of Surgical Pathology.

Aside from simple lipomas, in excess of 400 patients with soft tissue tumors are treated surgically at Brigham and Women's Hospital each year, including approximately 250 patients with sarcomas; there is also a joint Dana-Farber/Brigham multidisciplinary Soft Tissue Sarcoma Clinic treating more than 1000 patients annually for which Dr. Fletcher or Dr. Hornick reviews the pathology. In addition Dr. Fletcher has an international consult service for soft tissue tumor diagnosis and other oncologic pathology which receives more than 5,000 cases per year. Also available is an annotated teaching set of 350 soft tissue neoplasms, covering most of the diagnostic categories.

The responsibilities of an advanced Resident include:

- As needed, assist with the handling of soft tissue tumor resection specimens generated at BWH, including (where necessary) participation in the orientation and cutting in of such specimens and the acquisition and suitable apportionment of fresh tissue for special studies (including EM and cytogenetic analysis), snap-freezing and any other pre-defined use
- Prepare and review Dr. Fletcher's consult cases, as well as liaison with the SRSP in the handling and review of all institutional consults relating to the soft tissue pathology service
- Coordinate, prepare and present case materials for the Sarcoma Clinic Working Conference held every Monday at 8:00 am in the Department of Pathology at BWH
- Attend the daily Soft Tissue Signout
- Coordinate requests for special stains, immunohistochemistry and electron microscopy generated by the soft tissue tumor service
Women's and Perinatal Pathology

Supervisor: Christopher P. Crum, M.D.

Duration: 6-12 week advanced elective, or 1-2 year fellowship

Goals and Objectives:

This rotation, offered by the faculty and fellows of the Women's and Perinatal Division, provides the opportunity to develop competencies in women's and perinatal pathology through a comprehensive overview of obstetrical and gynecologic pathology by supervised specimen processing and interpretation in the gross room and frozen section laboratory, diagnostic sign-out with one-on-one feedback, didactic, tutorial and interactive teaching formats, and formal testing. At the end of the first year, residents should be able to identify morphologically and understand the clinical significance of the most common obstetrical and gynecologic pathologic entities, including pre-invasive and invasive neoplasms of the lower female genital tract, benign endometrium, endometrial hyperplasia and precancers, endometrial carcinomas, myometrial neoplasms, benign ovarian conditions, ovarian neoplasia, placental alterations associated with infection, toxemia and fetal growth retardation, trophoblastic neoplasia, and common dysmorphic abnormalities associated with genetic disorders. By the end of the second year, the residents should be familiar with the differential diagnosis of the above, and be able to present a series of diagnostic alternatives when confronted with situations in which the above described entities are under consideration. In essence, they will be expected to have achieved the knowledge base permitting competency in diagnostic practice.

Service Components:

- **Placental and Perinatal Pathology**: This consists of spontaneous abortuses, molar pregnancies, ectopic pregnancies, second trimester fetal deaths, and placentas from second and third trimester requiring special evaluation.

- **Biopsy Service (“Quicks”)**: This comprises primary lower female genital tract biopsies, endometrial biopsies and cervical cone biopsies, and is the largest component of the Women's and Perinatal service.

- **Large Specimen Service (“Bigs”)**: This service comprises all routine hysterectomies, oncology cases, risk reducing salpingo-oophorectomies, and occasional breast specimens. The Women’s and Perinatal Service accessions approximately 400 new oncology cases yearly.

Procedure:

General: Residents meet with the Director (Dr. Crum) and Women’s and Perinatal Fellow(s) the second day of their residency and are given an overview of the Women’s and Perinatal Divisional activities and expectations. During their rotations on Women’s and Perinatal Pathology, residents are closely supervised by the Women’s and Perinatal Fellow, who instructs them in basic specimen handling and processing, under the guidance of the Director and Staff. Each resident receives her/his slides early in the afternoon and is expected to review the slides, inspect and correct the pathology report as needed, and present the cases to the designated attending the following morning. The resident is expected to have a written
diagnosis for each case and will be instructed as to proper diagnosis, differential diagnosis and report formatting by the attending.

**Frozen Sections**: The procedure for frozen section diagnosis is as follows: Prior to noon, frozen section coverage is by the Women's and Perinatal Pathology Fellow, to free the resident for sign-out with their attending. In the afternoon, the resident on the biopsy service is responsible for frozen sections. The senior staff member on the Large Specimen Service is notified by the fellow/resident and reviews the gross and microscopic pathology in the Frozen Section Room. The senior staff member signs the Frozen Section Report when completed and the resident/fellow calls the surgeon and gives an oral report.

**Fetopsies**: The gross room procedure for second trimester fetal deaths is as follows: The resident discusses any issues regarding parental consent, burial arrangements or other clinical questions initially with Kathleen Sirois, the pathology assistant on the Women's and Perinatal Service. The attending staff member on the Placental and Perinatal Service is notified when the case is ready for examination and reviews all cases at the bench with the resident, with attention to malformations or the advisability of obtaining cytogenetics. Drs. Quade and Bieber may be called if additional questions arise regarding diagnosis and handling of these cases. If cardiac anomalies are suspected, the fetal hearts are routinely saved and reviewed with Drs. Boyd or Padera. Neuropathologic abnormalities are discussed with the fellow on the Neuropathology Service.

**Educational Opportunities:**

In addition to the hands-on contact in the gross room and at the microscope, residents have the opportunity to participate in the following teaching activities to rapidly increase their skills and other competencies in obstetric and gynecologic pathology, including:

- The Women's and Perinatal Conference (required attendance by all residents, not just those rotating through the division), devoted to timely topics, interactive teaching and occasional testing.
- The Trophoblastic Disease, Pap Smear/Biopsy Correlation, Women's and Perinatal Diagnostic, and GYN Tumor Conferences (residents on the service).
- Teaching materials from numerous post graduate courses conducted by the Women's and Perinatal staff, including slide sets and syllabi; and a large annotated case collection for review.
- A reference library in the Women's and Perinatal Division is also available.
**Research:**

During their rotation in the Women’s and Perinatal Division or when time permits, residents may participate in a range of research activities with members of the staff. The staff and their principal subspeciality areas in the field of obstetric and gynecologic pathology include:

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**Cytopathology**

**Supervisor:** Edmund S. Cibas, M.D.

**Duration:** 3 months dedicated rotation in core, divided between the first and second years of residency. Also available: advanced elective and 1 year fellowship

**Goals and Objectives:**

- To become competent in evaluating a wide variety of cytologic specimens: Pap tests, respiratory specimens, urine, body cavity fluids, GI brushings, and fine needle aspiration specimens.
- To distinguish benign proliferative changes from malignancy in cytologic specimens; to recognize the cytologic features of inflammation, infection, hormonal, and antineoplastic therapy, and tumors of all organs; to appreciate the significance of cytologic collection techniques and make appropriate clinical recommendations; and to distinguish between satisfactory and unsatisfactory cytologic specimens.
- To gain experience in performing fine-needle aspirations of palpable lesions.

The cytopathology rotation trains residents in the evaluation of cervical/vaginal Pap tests, respiratory specimens, urine, body cavity fluids, GI brushings, and fine needle aspiration (FNA) specimens. The rotation combines structured didactic teaching sessions with responsibility for screening a variety of cytologic specimens and participation in the final signout of cases. Residents are introduced to the principles of cytologic diagnosis by means of didactic microscopic tutorials. The resident has daily responsibility for previewing selected cases from the daily workload and participating the signout of those cases.

In addition to the core 3-month rotation, cytology is incorporated throughout surgical pathology and other subspecialty rotations by way of cytology/surgical pathology correlations and regular cytology conferences.

Residents' duties include: attendance at microscopic teaching sessions (series of sixteen); preview, evaluation, and written diagnosis of assigned specimens, including correlation of cell blocks with the corresponding cytologic smears; attendance at FNA procedures and performance of FNAs; attendance at cytology conferences; communication with clinicians to request clinical information or to report a diagnosis; and obtaining follow-up on interesting cases.

The Cytopathology Laboratory maintains an extensive collection of over 2,500 teaching cases. An up-to-date library of standard textbooks, references, and journals is maintained in the residents' workspace and Cytology Library.

Approximately 2500 consultation cases per year, including both gynecologic (Pap) and non-gynecologic cases, are available for review by rotating residents. The most unusual and/or problematic cases are reviewed at the weekly cytology case conference, attended by the residents.
The Laboratory evaluates over 3200 fine-needle aspirations per year. Residents attend deep-seated fine needle aspirations performed by radiologists, observe cytology staff perform on-site rapid evaluations of specimen adequacy, and then follow cases through to their final sign-out. Regarding FNAs of superficial lesions, residents are expected to perform at least six to ten aspirations during the rotation in the Fine Needle Aspiration Center.

Correlation of surgical and cytology cases is extensive. Residents review all cytologic specimens that have material processed like a histopathologic specimen (cell block). Residents attend the weekly Pap Smear/Biopsy Correlation Conference and the Cytology Staff Conference, at which cytologic/histologic correlation is reviewed.
NEUROPATHOLOGY

Supervisor: Rebecca Folkerth, M.D.

Duration: 4 weeks dedicated rotation in core and also available as 2 week first year elective and 2 year fellowship

Goal/Objective: To provide training and experience and develop competence in diagnosis of neuropathology autopsy and surgical material from both the Brigham and Women's and the Children's Hospital services. Dr. Rebecca Folkerth is Chief of Neuropathology at the Brigham and Women's Hospital, and is Director of the Longwood Training Program in Neuropathology, with Fellows at BWH, Children's Hospital Boston, and Beth Israel Deaconess Medical Center.

The rotation consists of a brief introductory training period, during which time the resident will be shown preferred techniques of specimen handling and reporting. Some of this will constitute a review, since all residents, as part of routine evening and weekend coverage, have already participated in intraoperative diagnosis of neurosurgical specimens, and, as part of routine autopsy rotations, have participated in brain-cutting sessions.

For surgical neuropathology, the rotating resident will be responsible at the Brigham and Women's Hospital for daytime frozen section preparation, gross dictation, organization of paperwork, and, with help from the neuropathology fellow, initial slide review and special study requests. He/she will be expected to learn techniques of handling stereotactic and open brain tumor specimens, seizure resections, ophthalmic material, and nerve and muscle biopsies, including electron microscopy, with supervision by neuropathology fellow or staff. He/she will attend daily morning surgical sign-out and participate in write-up of surgical reports.

The rotating resident will assist the neuropathology fellow in setting up and running the Brigham and Women's Hospital Tuesday brain cutting sessions (adult and perinatal). He/she will also review the medical records and, in consultation with the neuropathology fellow or staff, be responsible for prosection of autopsy brain, spinal cord, muscle, nerve, and eye specimens. Residents may help review autopsy slides and generate autopsy reports, as deemed appropriate by neuropathology fellow or staff.

Conference responsibility during the rotation includes preparation and presentation of one didactic conference (Children's weekly Neurology Meeting), the topic of which may be the choice of the rotator, with approval of neuropathology fellow or staff. Residents are expected to attend the regularly-scheduled departmental conferences, and may wish to attend relevant clinical and research conferences (Neurology and Neurosurgery Grand Rounds, Enders Neuroscience Seminars, etc.).

Teaching material available to the rotator includes a computer-indexed file of rare and classic examples of adult and perinatal neuropathology, collected since 1977; glass slide study sets of smear preparations and permanent sections, collected since 1988 from Brigham and Women's Hospital and Children's Hospital; glass slide study sets of normal neuroanatomy, electronic images of gross neuropathology from files, and from collections of senior staff; complete and up-to-date library of texts and monographs on Neuropathology, Neuroanatomy, and clinical Neurology and Neurosurgery.
DERMATOPATHOLOGY

**Supervisor:** George F. Murphy, M.D.

**Duration:** 6 weeks dedicated rotation in core and also available as 1 year fellowship

**Goals and Objectives:**

- To gain a basic understanding of diagnostic dermatopathology, i.e., to develop a systematic approach to evaluating a skin biopsy, to gain the basic knowledge needed to generate a differential diagnosis for most problems in dermatopathology, and to gain an appreciation for particular problem areas in skin pathology.
- To gain an understanding of basic methods routinely used in dermatopathology, including particular special stains, immunofluorescence, and immunohistochemistry, and a familiarity with the types of the skin specimens commonly encountered and their appropriate processing for examination.
- To gain an appreciation of the importance of clinicopathologic correlation and communication with clinicians concerning diagnosis.

To accomplish these goals, the pathology resident will:

- Participate in the routine activities of the Dermatopathology division, including: (i) The daily signout each morning at BWH. Having previously reviewed the cases and formulated a differential diagnosis, the resident will attend the signout with the attending dermatopathologist and the dermatopathology fellow. (ii) The weekly Dermatopathology Teaching Conferences, at which the resident will be responsible for discussing cases. (iii) The weekly noon conferences at Children's Hospital,
- Learn the basics of "grossing" specimens for histologic examination, i.e., curettage, shave, punch, and excisional specimens, and participate in preparing these specimens. There will be particular attention paid to orientation, margins, etc. The resident will be responsible for obtaining all levels and/or specimen stains.
- Review a comprehensive set of teaching cases. Publication of clinical research is encouraged.
HEMATOPATHOLOGY

Supervisor: Jon Aster, M.D., Ph.D.
Duration: 4 weeks dedicated rotation in core and also available as 1 or 2 week first year elective, 3-6 month advanced elective, or 1-2 year fellowship

Goals and Objectives:

- To gain a broad exposure to diagnostic hematopathology including: proper tissue processing, diagnosis of bone marrow, lymph node, spleen, and other tissues involved by hematologic diseases.
- To appreciate the diagnostic applicability of special stains and phenotypic and genotypic studies and cytogenetics in evaluation of these disorders.

The resident works closely with one of the Hematopathology Fellows in the cutting room and subsequently in the signout room for tissue processing (which requires different techniques, contingent on specimen type and the disorder to be assessed) and for formulation of a diagnosis when slides of the specimen become available. The material evaluated includes fresh biopsies and slide consults. Following an initial introductory period, a resident is then expected to present his or her cases at daily morning signout, having obtained ancillary clinical information on cases, as necessary, and also to attend the portion of the signout of cases which have been prepared by the Hematopathology Fellows, including consult cases. These cases are available to the resident for preliminary review on the evening prior to signout. The resident also participates in evaluation of frozen sections, which may be requested in hematologic cases. Residents who choose extended rotations (3 months or more) on the service will ultimately assume the responsibilities of a Hematopathology Fellow after an initial training period.

Hematopathology Fellows either assume responsibility for handling all in-house specimens (in consultation with senior staff), reviewing consults from surgical pathology and specialty services, and handling selected outside consults, or assume responsibility for all other consult cases including outside cases submitted for marker studies and/or consultation. All cases are signed-out with senior staff hematopathologists. Fellows are also responsible for presenting cases at Dana Farber/Partners Cancer Care Conferences. The hematology fellows (one year training program) will also have rotations in the Hematology Laboratory and at Children’s Hospital Medical Center for training in pediatric hematology.

In addition to the above responsibilities, the resident attends the bone marrow aspirate tutorial session in the Dana Farber Cancer Institute Special Hematology Lab, the weekly Hematopathology Interesting Case Conference, and the Dana Farber/Partners Cancer Care Conferences in which hematologic cases are discussed.

Additional teaching material includes slide and kodachrome study sets, a variety of hematology and hematopathology books, and a notebook of key articles. Residents and/or fellows may also be involved in preparation of manuscripts of unusual cases or specific hematologic topics for publications in peer reviewed journals.
AUTOPSY PATHOLOGY

Supervisor: Gayle L. Winters, M.D.
Duration: Approximately 2 month rotation in core

Goals and Objectives:

- To teach residents to recognize disease, make clinicopathologic correlations and convey information to clinicians.
- To teach residents how to dissect and describe organs and lesions, submit tissue blocks for microscopic sections, and analyze the histology.

The Autopsy Pathology service does over 200 postmortem examinations each year, including adult and perinatal cases. The hospital autopsy rate is approximately 20%. A Guide to Autopsy Division Procedures and Policies provides detailed assistance in methodology, documentation and administrative procedures and is updated yearly. The Director of Autopsy Pathology is Dr. Gayle Winters.

Typically, one resident covers the Autopsy Service during which they perform autopsies, present them at the Gross Conference, and sign them out with the autopsy senior staff. The pace is quite variable with an average of 3-5 cases per resident per week. The Chief Resident oversees and is an integral part of the autopsy service.

Residents begin a postmortem examination with review of the chart and phone discussion with physicians caring for the patient concerning clinical questions. The resident then reviews with the senior pathologist (1) validity of the autopsy permit, (2) need for subspecialty consultation, (3) need for infectious precautions, (4) general approach to the case, and (5) key clinical questions to be answered by the autopsy. After the training period comprising several cases at which the Chief Resident and/or senior pathologist are present throughout, residents contact the Chief Resident or senior pathologist at any time during subsequent autopsies when questions arise. In all cases, following a dissection which takes 2 to 5 or more hours depending on complexity and prosector experience, the resident and senior pathologist review the organs in detail. They also decide how the case will be presented at the Gross Conference and which grossly selected lesions may benefit from frozen sections or paraffin-embedded sections processed overnight in order to render a definitive diagnosis rapidly, often in time for the Gross Conference and to be included in the preliminary report to the clinicians.

A resident on the Autopsy Service attends and present his/her cases at the Gross Conference (3 per week), including a short clinical summary, presentation of the gross specimens, and review of any available microscopic sections, followed by discussion. For cases where organs must be returned to the body at the end of prosection, the resident presents the findings at the Gross Conference using a Powerpoint presentation. The conference is typically attended by at least 4 senior staff pathologists, including Drs. Schoen, Padera, Winters, and the senior pathologist assigned for that week, as well as residents, rotating medical students, subspecialty fellows and staff, and neuropathology residents and fellows. In addition, a radiology resident assigned to the Autopsy service presents pertinent images. Clinicians and their house staff are encouraged to and often do attend Gross
Conferences where patients they have cared for are discussed. The resident prosector cuts in the specimens, writes up the Preliminary Anatomic Diagnoses (PAD) document which is reviewed with and signed out by the senior pathologist and distributed to the clinicians.

He/She later writes the Final Anatomic Diagnoses (FAD), following both detailed examination and review of the microscopic sections with the senior pathologist. PADs are signed out within 2 days, while the FADs take on average approximately 1 month; both are immediately and automatically available to clinicians on the hospital-wide computer system. The resident prosector also cuts the brain on his/her autopsies and generates a gross description and final neuropathology report based on clinical history, gross findings, and histologic sections under the direction of the neuropathology fellow and/or staff. Subspecialty pathologists provide formal consultation on selected cases as appropriate. Most autopsy cases are presented to the clinical services at Medical, Surgical, and Cardiology Morbidity and Mortality/Clinicopathologic Conferences, Dana-Farber Oncology Conference, Neurology/Neuropathology Conferences, as well as others. Many cases are presented at various pathology departmental conferences.

Autopsies on non-BWH patients are frequently received in consultation and may consist of a complete autopsy or single organs (e.g. heart or brain). Residents are routinely assigned to these cases and work them up under the supervision of the autopsy senior staff.

As residents become more proficient, they assume more responsibility for the total workup and presentation of their cases, including selecting and notifying appropriate subspecialty consultants, deciding on a method of dissection (when options are available) which best displays the pathologic findings, communicating independently with clinicians, and completing the full write-up of the case including microscopic descriptions and finalizing the FAD prior to sign-out with the senior staff. Some senior residents and fellows serve as sub-attendings on the autopsy service with final signout supervised by the senior pathologist.
**FORENSIC PATHOLOGY**

**Supervisor:** Henry Nields, M.D.

**Duration:** 2 week rotation in core

**Goal/Objective:** To introduce residents to the principles of forensic pathology and the approaches to a medico-legal autopsy.

Anatomic Pathology residents rotate for 2 weeks in the Office of the Chief Medical Examiner for the Commonwealth of Massachusetts in downtown Boston. For residents with special interest in forensic pathology, longer rotations can be arranged.

Residents usually spend the mornings in the autopsy room observing and assisting the medical examiners in the various approaches to the investigation and certification of traumatic and unknown causes and manners of death. Work rounds are made with the chief medical examiner with table side discussions each morning.

In the afternoon residents are expected to participate in the daily case discussions ("sign-out" rounds) between the senior staff and the chief medical examiner. Residents who participated in cases may present them at these meetings. Weekly seminars for the medical examiners ("grand rounds") are open, and visiting residents are encouraged to attend.

Opportunity is available to residents to go to scenes of death with our investigators and to go to court when pathologists testify.
**PEDIATRIC PATHOLOGY (CHILDREN’S HOSPITAL)**

**Supervisor:** Theonia Boyd, M.D.

**Duration:** 4 week dedicated rotation in core; also available as 1 year fellowship through Children’s Hospital

**Goal/Objective:** To teach residents to recognize pediatric diseases and to understand the relevant clinicopathologic correlations.

Each Brigham and Women’s Hospital pathology resident spends 4 weeks in the Department of Pathology at Children’s Hospital Boston, doing both surgical and autopsy pathology. Most residents rotate during their second year. Residents perform service functions, including workload distribution, identical to that of the pediatric pathology fellows.

The Surgical Pathology service is divided between in-house and consult specimens. While doing in-house specimens, a resident will also cover frozen sections during the week. A physicians’ assistant aids in processing many of the specimens. Typically a resident will gross in specimens one day, receive slides back the next day, preview them, and sign them out with the senior later that same day or the following morning.

While on consults, a resident is responsible for all outside consultations, as well as all in-house renal, dermatology, hematopathology and gastrointestinal cases. Outside consults are reviewed with the in-house senior staff. All other consult cases are reviewed with subspecialty consultant pathologists.

The Autopsy service at Children's Hospital does perinatal, pediatric and adolescent autopsies. An autopsy technician aids in the postmortem examinations. The protocol is similar to that at the Brigham; a resident does the autopsy, presents the case at gross conference, writes the preliminary report, cuts in the case, signs it out with the senior, and writes the final report. The resident is also responsible for cutting the brains on his autopsies, as well as reviewing and writing up the neuropathology reports, and covering frozen sections on weekends.

While at the Children's Hospital, residents also have the chance to review cases from the world famous cardiac registry of Drs. Richard and Stella van Praagh (now directed by Dr. Stephen Sanders). Residents are also required to sign off on having reviewed a collection of 100 slides of typical pediatric lesions. The performance of each rotating resident is evaluated in writing and filed with the Program Coordinator. The Program Director schedules a verbal exit interview with each rotating resident at the conclusion of the rotation.
**INDEPENDENT STUDY**

In order for residents to have time away from diagnostic services to explore and plan for pathology subspecialty and/or research careers, residents are assigned to an independent study period of 1 week during the first year and 2 weeks during the second year. This time may be used for activities such as attending signout in a subspecialty area of interest, exploring and interviewing for positions in research labs, writing grants, preparing or presenting abstracts, completing manuscripts, etc.

**ADVANCED ELECTIVE ROTATIONS**

Advanced elective rotations of 1-6 months and in some subspecialties, fellowships of a full year or more duration are available in pathology subspecialties, including cytopathology, dermatopathology, hematopathology, neuropathology, as well as breast, cardiac, gastrointestinal, genitourinary, pulmonary, renal, soft tissue, and women's and perinatal pathology, and molecular genetic pathology and cytogenetics.
DESCRIPTION OF CLINICAL PATHOLOGY ROTATIONS

The Clinical Pathology Rotations are designed to provide training for the pathologist to direct the operation of the clinical laboratory in all of its aspects (methodology, quality control, clinical interpretation of laboratory tests and administration) and to provide opportunities for subspecialty or investigative work during the training period. The Clinical Pathology Laboratory is directed by Dr. Milenko Tanasijevic.

Training in Clinical Pathology is directed toward residents acquiring proficiency in 3 major areas:

- **Technical Expertise:** This requires an understanding of the principles of test methodology to allow trouble-shooting, identify interferences, evaluate new instrumentation/techniques, and monitor appropriate specimen collection, etc. Most of these skills are best acquired by being in the laboratory and interacting with medical technologists and technical supervisors.

- **Medical Knowledge:** Clinical pathologists function as the "bridge" between clinical practice and laboratory analysis. Residents should learn how to interpret laboratory tests and apply this knowledge to assist clinicians in patient diagnosis and management. This includes interaction with clinicians, appropriate utilization of the laboratory, interpretation of test results, etc.

- **Management:** Administration, data management, cost containment, reimbursement and quality control are all important aspects of Clinical Pathology. These are covered in formal lectures and learned by the involvement of residents in the routine administration of the laboratories.

The rotations encourage active participation by the resident in the daily functions of the laboratory. The resident's duties and responsibilities vary from laboratory to laboratory, but these duties include interpretation and reporting of significant laboratory findings, active participation in quality control programs, clinical problem solving, and functioning as a liaison between the laboratory and clinical staff. Residents actively participate in teaching seminars for students, residents, and staff. The program is sufficiently flexible to provide time for residents to receive in-depth training and experience in subspecialties of particular interest, without jeopardizing the overall training experience. As the clinical laboratories comprise sites rich in technology implementation and clinipathologic correlation, residents are encouraged to become involved in projects in clinical, translational, and basic research.

Core training in Clinical Pathology for third-year AP/CP Residents consists of 3-month rotations in each of the four core laboratories: Clinical Chemistry, Microbiology, Transfusion Medicine/Blood Bank, and Hematology. Core training for first-year CP Residents consists of 3-month rotations in four laboratories (Clinical Chemistry, Microbiology, Hematology and Molecular Diagnostics). CP Residents complete their core Transfusion Medicine/Blood Bank rotation early in their second year. The resident's experience during each of these core rotations is a combination of one-on-one didactic teaching with faculty, group conferences and lectures, hands-on experience in test interpretation/reporting, clinical consultation, and laboratory management, and mentored research/development projects. For CP Residents, the second and third years of residency are individually tailored to meet each resident's specific career goals, and include a customized combination of electives, advanced core
rotations, possible service as Chief Resident, and research. For AP/CP Residents, at least six additional months of training are spent in elective rotations such as molecular diagnostics, cytogenetics, or informatics, service as Chief Resident, and/or advanced rotations in any of the core or subspecialty laboratories.

**Clinical Chemistry**

**Supervisor:** Petr Jarolim, M.D., Ph.D.

**Duration:** 3 months

**Goals and Objectives:**

- To learn the medical, technical and managerial aspects of Clinical Chemistry laboratory operations, and those of related laboratories (Cytogenetics, Molecular Diagnostics, Immunology, Toxicology, and Reproductive Endocrinology)
- To develop an understanding of the techniques utilized in the Clinical Chemistry and related laboratories
- To be knowledgeable about the influence of pre-analytical factors, analytical variables, specimen variables, effects of age, sex, race, method, timing, or patient diagnosis on the interpretation of test results
- To understand how to select, validate, implement and maintain a clinical test
- To understand the regulations and requirements of various accrediting agencies with regards to all aspects of clinical laboratory operations
- To interpret and apply laboratory tests to the diagnosis of disease and monitoring of patient therapy
- To be able to advise physicians on proper test strategy and interpretation of laboratory tests for diagnosis of patient's disorder or monitoring of treatment
- To develop a scientific, analytical approach to problem solving
- To understand and use medical informatics
- To be adept at evaluating publications related to clinical chemistry
- To manage, communicate, educate, and cooperate with laboratory technicians, technologists, and technical supervisors
- To understand basic medical economics as it pertains to laboratory operations

**Activities and Responsibilities:**

At the start of the rotation, each resident meets with the course director who details the responsibilities and expectations of the rotation, outlines the testing performed in each laboratory, and provides resources and contact information. A schedule outlining the weekly laboratory rotations within clinical chemistry is distributed (outlined below).

Residents are strongly encouraged to interact with both the supervisors and technologists in the laboratory and the clinicians responsible for patient care, in order to derive the maximum benefit from the wealth of clinical material available. Each resident carries a beeper to facilitate consultation with clinicians in the interpretation and utilization of laboratory tests. In addition to daily contact, all beeper calls are formally discussed with the Medical Director at a weekly meeting, and a member of the Chemistry faculty is always available “on call” for guidance.
Each weekday during the rotation in Clinical Chemistry, residents interpret and report protein electrophoresis and immunofixation analyses, review requests to send patient samples to other labs for highly specialized testing, and participate in didactic teaching sessions with the attending pathology faculty.

During the course of the Clinical Chemistry rotation, the residents participate in and/or lead a weekly “Journal Club” literature review, give two teaching presentations to the technical staff, conduct a mock laboratory inspection following College of American Pathologists (CAP) guidelines, perform a detailed review of one test offered by the laboratory and, if interested, participate in innovative research projects with selected faculty members.

**Schedule and Curriculum:**

The curriculum is arranged around didactic sessions with the attending faculty, “hands-off” bench experience with technologists and supervisors, and independent learning.

The following bench experiences are offered:

- Specimen Receipt and Processing
- Blood Gases
- General High Throughput Chemistry
- Immunoassays
- Toxicology and Therapeutic Drug Monitoring
- Protein Electrophoresis and Immunofixation
- Infectious Disease Markers
- Special Chemistry
- Immunology
- Reproductive Endocrinology
- Point of Care Testing

The daily didactic sessions with attending physicians include topics in clinical chemistry such as analytical methodologies, clinical applications of laboratory tests, case-based learning, management, toxicology and therapeutic drug monitoring and multiple sessions in molecular diagnostics.

On completion of their core rotations, residents may elect to undertake a more advanced rotation in Chemical Pathology. During this time residents take on increased responsibility in the laboratory. Duties during advanced rotations include, but are not confined to:

- Teaching junior residents and medical students
- Supervision of technical staff in the evaluation or implementation of a new assay or analyzer
- Participation in clinical trials and/or innovative research that should lead to publications in peer-reviewed journals.
MICROBIOLOGY

Supervisor: Andrew B. Onderdonk, PhD.
Duration: 3 months

Goal/Objective: To provide technical insight and expertise with the various methods used for isolation and identification of microbial pathogens, including viruses, as such methods relate to the diagnosis of infectious disease and patient care.

The resident becomes familiar with the techniques used for the isolation, identification and antimicrobial susceptibility testing of pathogenic bacterial pathogens. This is accomplished through rotations at the various benches of the bacteriology section. The resident is expected to be familiar with standard methods for characterization of bacteria, techniques for in vitro susceptibility testing and interpretation of special procedures for the detection of bacterial pathogens. At some point during the rotation, each resident is responsible for performing standard test procedures and for reporting results, under the supervision of a trained microbiologist. Procedures used for the serologic detection of viral antigens are presented during the rotation in the Virology section. Additional rotations include molecular diagnostics using PCR, TMA and viral load assays and exposure to the Special Microbiology area which includes anaerobic bacteriology, parasitology and mycology.

The resident participates in regular meetings with the Director and Associate Medical Directors to discuss various topics relating to clinical microbiology. In addition, residents attend Infectious Diseases clinical conferences and rounds and serve as the laboratory liaison with the I.D. service for specific cases. This allows the resident to gain insight into both clinical and laboratory problems as they relate to infectious diseases. The resident also presents clinicopathologic information at weekly joint Infectious Disease-Microbiology rounds. Ample opportunities to discuss specific issues with the medical director and staff of the laboratory are available.

The resident rotates through the following areas: sample accessioning, plating media, susceptibility setup and reading, blood cultures, serology, gonococcal cultures, identification systems, reading bench, molecular diagnostics, special microbiology (anaerobic bacteriology, parasitology, mycology), virology, chlamydia and mycoplasmas.

This schedule may be modified according to the resident's interests and needs and additional time in each of the above-mentioned areas can be arranged.
**Transfusion Medicine (Blood Bank)**

**Supervisor:** Richard Kaufman, M.D.  
**Duration:** 3 months

**Goal/Objective:** To develop theoretical and practical knowledge of the various aspects of the activities of a transfusion medicine physician in a hospital setting.

The resident participates in the daily operation of the Blood Bank as both student, teacher and coworker. He/she particularly seeks to function as the medical interface of the laboratory with physicians on other services with the aim of providing all patients with optimal transfusion therapy.

The Transfusion Medicine rotation takes advantage of the educational resources at BWH, CHB and DFCI, providing a broad range of exposure to the field. Four major areas are covered in this rotation.

- **Blood Bank Laboratory activities:** blood components preparation, pretransfusion compatibility testing, and infectious disease testing.
- **Transfusion Service activities:** management of allogeneic and autologous blood donation issues, management of clinical problems involving outpatients or inpatients receiving blood transfusion, with special emphasis on evaluating transfusion reactions and helping to manage acute bleeding/massive transfusion situations.
- **Therapeutic Apheresis Service:** inpatient and outpatient management of patients requiring plasma exchange, red blood cell exchange and other therapeutic apheresis procedures.

**Regulatory Compliance/Administration:** residents are exposed to major issues in blood banking policy, and managerial/organizational issues for a hospital based transfusion service. Special emphasis is placed on approaches to improve safety and efficiency, and reduce costs.
Hematology

Supervisor: David M. Dorfman, M.D., Ph.D.
Duration: 3 months

Goals and Objectives:

• To become familiar with the different laboratory testing and diagnostic techniques used in the Hematology Laboratory.
• To learn the application and value of these methods in the differential diagnosis, monitoring and the treatment of hematopoietic disorders.

The resident rotates through the following sections: Routine Hematology, Special Hematology, Special Coagulation and Flow Cytometry. The resident is provided with a series of tutorials covering a range of topics in laboratory hematology. This includes training sessions on peripheral blood morphology and core hematology laboratory instrumentation. The resident spends a portion of time at the microscope, viewing slides of interesting cases for altered red cell morphology and for white blood cell differential counting. There is a large teaching collection available in the hematology laboratory to enable residents to become familiar with normal and pathological samples. The Special Hematology service introduces the resident to more specialized diagnostic tests, including hemoglobin electrophoresis and enzyme histochemistry. In the Special Coagulation Laboratory, the resident will assist in the performance of the full range of tests used to evaluate clotting and platelet disorders. While rotating through the Flow Cytometry Service, the resident learns the value of this technique to phenotype leukemias and lymphomas. Throughout the rotation, the resident is given responsibility for drafting interpretive reports on flow cytometric immunophenotypic analysis of lymphomas and leukemias, coagulation disorders, and electrophoretic analysis of abnormal hemoglobins. These interpretations are reviewed, along with laboratory test results, at daily signout and teaching sessions with the attending hematopathologist.

An essential part of this rotation is the daily contact with hematology fellows and attendings. With these continuous interactions, the resident will be able to follow patients during their hospital stay from both a clinical and laboratory point of view. The Bone Marrow service (integrated with Anatomic Pathology) allows the resident to correlate pathologic findings from bone marrow aspirate microscopic examination, bone marrow biopsy examination, and pertinent hematology laboratory test results. Opportunities also exist to participate in clinical studies to evaluate new clinical instruments and laboratory tests.
SPECIALTY LABORATORY ROTATIONS

Residents spend time as part of the "core" rotation in each of the specialty laboratories listed below. For residents wishing further training, advanced rotations are available in these laboratories as well as the core laboratories described above (e.g., advanced hematology, flow cytometry), molecular biology and cytogenetics.

IMMUNOLOGY

Supervisor: Peter H. Schur, M.D.
Duration: 1 week

Goal/Objective: To expose the resident to a very broad range of testing techniques for antigens, antibodies and other substances of importance to current medical practice.

The activities of this laboratory are particularly closely coordinated with both inpatient and outpatient care. Active research in relevant advanced laboratory methods is integrated with the service function of this laboratory.

Additional resident education in flow cytometry/immunology/serology is divided among several rotations where the assays are performed. These include hematology, tissue typing, microbiology and chemical pathology. Residents have exposure to methodology, interpretation, and potential pitfalls of immunodiffusion, immunoelectrophoresis, ELISA, immunofluorescence, nephelometry, hemolytic complement, and cryoprecipitation. During this rotation, residents observe technicians in performance of each assay from the beginning to the end, read publications, and meet with the Medical Director on a regular basis to review interpretation of assays.

REPRODUCTIVE ENDOCRINOLOGY

Supervisor: George Mutter, M.D.
Duration: 1 week

Goal/Objective: To expose the resident to the theoretical basis and clinical application of laboratory andrology and reproductive hormone testing.

The Reproductive Endocrinology Laboratory provides comprehensive andrology and reproductive endocrine testing services for patients seen at Brigham and Women’s Hospital and supports the IVF (In-Vitro Fertilization) program of BWH's Department of Obstetrics and Gynecology. The resident will be introduced to diagnostic (semen analyses) and therapeutic (sperm washing and banking) andrology services, in addition to reproductive hormone assessment on a variety of automated immunoanalysers. The resident has the opportunity to review the indications, diagnostic value and limits of all procedures.
Tissue Typing

**Supervisor:** Edgar L. Milford, M.D.

**Duration:** 1 week

**Goal/Objective:** Expose the resident to techniques used to determine histocompatibility antigens in recipients and donors for kidney and other organ transplantation.

As the regional reference laboratory of the New England Organ Bank, this laboratory does testing for donor programs in many active clinical centers. Residents have a highly structured experience with exposure to the basic principles of clinical laboratory testing for solid organ and bone marrow transplantation as well as HLA and disease susceptibility. They follow the process used to type donors, study sensitization in recipients and understand the criteria of choice of the most appropriate match. This laboratory also conducts vigorous clinical and basic research programs.

Residents read relevant basic science and several technique manuals, and self-administer an instructional slide set for histocompatibility prepared by the American Society for Histocompatibility and Immunogenetics. They meet with the laboratory supervisor daily to review technical aspects of HLA typing, crossmatching, serum antibody analysis, and DNA genotyping using polymerase chain reaction techniques. Under supervision of a senior technologist and the laboratory supervisor they perform HLA phenotyping on themselves. Residents attend the weekly laboratory meeting, where both technical and administrative issues are discussed and resolved. They meet with the Medical Director three times for formal tutorial sessions and to review the work they have done in the laboratory. Interested residents have the opportunity to take an extended elective to master the technical and theoretical aspects of histocompatibility testing, following which they serve as consultants.

Endocrinology-Hypertension

**Supervisor:** Vincent Ricchiuti, Ph.D.

**Duration:** 1 week

**Goal/Objective:** To enhance the resident's understanding of the highly-integrated hormonal systems of the pituitary, thyroid, parathyroid, and adrenal (glucocorticoid and mineralocorticoid) axes.

This research laboratory provides analysis of 37 hormones, most of which are included as dynamic tests. Training involves enhancing the resident's understanding of the highly-integrated hormonal systems of the pituitary, thyroid, parathyroid, and adrenal (glucocorticoid and mineralocorticoid) axes. Residents rotating through the laboratory attend daily Endocrine Rounds, consult with endocrine fellows and meet with staff to discuss laboratory evaluation of endocrine function. Additional experiences include evaluating assay performance, as well as hands-on experience.
**ADVANCED ELECTIVE ROTATIONS**

Advanced elective rotations of 1-6 months and in some subspecialties, fellowships of a full year or more, are available in clinical pathology subspecialties, including clinical microbiology, clinical chemistry, transfusion medicine, and hematology.

During advanced rotations in the clinical laboratories, residents participate, under close supervision, in responsibilities typical of those performed by the medical directors. These include evaluation of cost-effectiveness of current procedures and assays, selection and evaluation of new assays and instrumentation, and their validation. Furthermore, residents have the opportunity to get involved into clinical research projects. In blood banking, residents act as the transfusion medicine fellow supervising and instructing CP residents in their core year and have the opportunity to get exposed to the work of the stem cell laboratory in addition to participation in research projects.

Advanced elective rotations are also offered to CP residents in molecular diagnostics and other subspecialties as arranged with the program director. Some examples of advanced electives are listed on the following page. These are neither comprehensive nor inflexible.

**EXAMPLES OF ADVANCED ROTATIONS IN CLINICAL PATHOLOGY**

1. **CLINICAL CHEMISTRY:**
   A. **Serum and urine protein electrophoresis.** Senior residents take primary responsibility for interpretation and reporting of serum and urine electrophoresis and immunofixation service, and participate in weekly rounds with the clinical myeloma group. Opportunities for evaluating new technologies and collaborating on clinical research trials in myeloma diagnostics and care will be explored.

   B. **Clinical applications of mass spectrometry.** Senior residents receive in-depth training in the principles and techniques of tandem mass spectrometry in the clinical lab. Residents get hands-on experience, under technologists’ guidance, in the use of the equipment, and will develop a new LCMS assay during the rotation.

2. **HEMATOLOGY:**
   Advanced electives have a special emphasis on flow cytometry, coagulation, special hematology (red blood cells studies, including hemoglobin electrophoresis), and/or core hematology laboratory testing. The advanced elective includes participation in test performance (including quality control and proficiency testing), creation of interpretive reports, new test development and new instrument evaluation, and clinical research.

3. **MICROBIOLOGY:**
   Options include a more comprehensive service rotation that includes all aspects of the clinical microbiology laboratory for those residents interested in managing a clinical microbiology laboratory, or specialization in one area such as parasitology, mycology, virology, bacteriology or molecular diagnostics. For those interested in specialty areas, residents can gain experience in public health microbiology, infection control or emerging infectious diseases such as MDR TB or antibiotic resistant bacteria within the hospital environment. Opportunities are also available for learning assay development and implementation, particularly in the area of molecular diagnostics. The clinical microbiology laboratory works closely with the Infectious Diseases service, the pharmacy, Infection Control, Harvard Medical School and Harvard School of Public Health to provide
training opportunities that can be customized for individual residents.

4. **Blood Bank:**
   Residents serve as the acting fellow for the clinical service. During the six-month elective, one month is dedicated to clinical service, where the senior resident takes first call and helps to orient and train the junior resident on the service. The remaining five months are dedicated to a research project, which can range from one or more ongoing clinical research protocols in the division, or can be translational or basic in nature.

5. **Molecular Diagnostics:**
   Senior residents share responsibilities with the molecular genetic pathology fellow in the management and interpretation of test results in hematology, oncology, microbiology, and clinical genetics. Residents participate in weekly clinical rounds with maternal-fetal medicine specialists in the Obstetrics department, and with clinical geneticists from the Children’s Hospital Genetics department. Residents will have the opportunity to learn from technologists at the bench, and lead efforts in developing a new molecular diagnostic assay. Residents also have the opportunity to rotate in, observe technologists, and sign-out cases within the cytogenetics laboratory.

6. **Other Possibilities:**
   A. Clinical trials management
   B. Point-of-care testing
   C. Outpatient laboratory management
   D. Clinical laboratory informatics
   E. Laboratory management or Chief Resident
   F. Transplantation diagnostics
   G. Reproductive endocrinology
   H. Clinical laboratory immunology
   I. Pediatric clinical chemistry
MOLECULAR DIAGNOSTICS AND CLINICAL CYTOGENETICS

Translational Molecular Pathology has been adopted as a Department-wide organizing principle to provide a forward-looking dimension to the various subspecialties of both Anatomic and Clinical Pathology and function as the integrating principle between the two disciplines. This organization has important implications for the integration of basic, clinical and translational research activities within the Department, the training of the next generation of physicians-scientists, and the realization of an institutional vision for Personalized Medicine.

MOLECULAR DIAGNOSTICS

Supervisor: Neal I. Lindeman, M.D.
Duration: Two weeks during AP (integrated with cytogenetics) and 3 months during CP; also available as a 3-month elective or 1 year fellowship

Goals and Objectives:

- To provide exposure to the theoretical and practical basis of molecular genetic pathology through reading, observation and hands-on participation and data interpretation.
- To understand the range of molecular laboratory methods used in molecular diagnostics.
- To understand the utility of molecular genetic pathology in the diagnosis, prognosis and clinical management of neoplastic diseases and appreciate the interface of molecular diagnostics and cytogenetics.
- To review molecular laboratory results and discuss their integration into comprehensive diagnostic and therapeutic strategies.
- To provide exposure to quality assurance, risk management, and cost effectiveness as they relate to molecular genetic pathology.

The Molecular Diagnostics Laboratory performs about 6000 tests annually, and pioneers new techniques in this area. Although a specific rotation in this laboratory is assigned for residents during AP and CP, molecular pathology is integrated throughout the resident's training, as we believe it is a critical component not only in today's practice but also for translational research in pathology. The laboratory tests center on lymphoma and leukemia by assessing clonality through antigen receptor rearrangements or by identifying specific chromosomal translocations at the molecular level for diagnosis, prognosis and minimal residual disease evaluation. Molecular testing on solid tumors includes EGFR mutational analysis in lung adenocarcinoma to predict therapeutic response to tyrosine kinase inhibitors and promoter methylation analysis on glioblastoma multiforme to predict response to temozolamide. Genetic tests for inherited disease/risk, such cystic fibrosis screening and Factor V Leiden, are also performed. The techniques employed include Southern blot hybridization, PCR, RT-PCR, real-time quantitative PCR, capillary gel electrophoresis, sequencing and Third Wave Technology Invader assays.

Interpretative skills of the laboratory results are acquired through tutorial and sign-out sessions with the attendings and fellows that address the specific technical issues and interpretive pitfalls inherent in each of the assays. In addition, the residents participate in the weekly laboratory sign-out where the correlation of these tests with other clinical and pathologic data is stressed as well as the related issues of quality assurance and cost-
effectiveness. The residents are encouraged to independently review the results prior to the sign-out sessions. The wording of the resultant interpretive reports is discussed with the resident at this session and the report finalized by the senior pathologist. The residents are provided with a packet of pertinent literature for independent readings. Electives for those wishing further in-depth experience are available.

A formal fellowship in Molecular Genetic Pathology is also available. Dr. Lindeman is the Program Director for the Harvard Medical School Molecular Genetic Pathology Training Program. This one-year accredited fellowship provides extensive training in broad areas of molecular diagnostics and molecular genetics including malignant disease, infectious disease, identity testing and inherited genetic disorders/predisposition. The fellows rotate through molecular diagnostic laboratories at four Harvard-affiliated teaching hospitals, including the Brigham and Women’s Hospital, Massachusetts General Hospital, Children’s Hospital and the Beth Israel Deaconess Medical Center. Fellows also participate in genetics clinics at these institutions and the Dana-Farber Cancer Center. The fellowship is integrated with the HMS Genetics Training Program and shares a year-long didactic program.

The professional staff associated with the Molecular Diagnostics Lab are: Michael Kluk, M.D., Ph.D., Frank Kuo, M.D., Ph.D., Neal Lindeman, M.D., Shuji Ogino, M.D., Ph.D. and Scott Rodig, M.D., Ph.D.
CLINICAL CYTOGENETICS

Supervisors: Azra H. Ligon, Ph.D., Cynthia C. Morton, Ph.D.
Duration: One week during CP, two-week integrated rotation with Molecular Diagnostics during 1st year of AP, and also available as a two-year ABMG-accredited fellowship

Goals and Objectives:

• To provide exposure to the heterogeneity, variability, and natural history of human cytogenetic disorders through reading, observation, hands-on participation and data interpretation
• To understand the range of cytogenetic methods used in establishing diagnoses and in providing risk assessments
• To understand the utility of cytogenetics and molecular genetic pathology in the diagnosis, prognosis and clinical management of neoplastic diseases and appreciate the interface of these methods
• To appreciate the importance of family and medical histories, physical examination, correlation with other laboratory data, and both written and verbal communication with clinicians
• To understand issues of quality assurance, risk management, genetic privacy, and cost effectiveness as they relate to cytogenetics and molecular genetic pathology

The cytogenetics rotation involves:

• Attendance at a weekly one hour working case conference, during which interesting abnormal cases are presented for group discussion. Case conference reviews involve discussion of patient history, pathology findings, ancillary test results (including ultrasound, methylation testing, etc.), cytogenetic test results, impact on diagnosis, and genetic counseling implications. Weekly attendance at Genetic Walk Rounds, which covers interesting cases from the Genetics Service at Children’s Hospital, is expected.
• Over the course of the rotation, residents will appreciate, either through observation or direct participation, the basis for the many methodologies used by the Laboratory. Each resident is supervised by a Senior Cytogeneticist, who incorporates resident participation in case review, data interpretation, case sign out, and communication of results to healthcare providers.
• The rotation offers many opportunities to correlate cytogenetic results with pathology gross and microscopic findings, discuss instances in which ancillary testing is indicated, as well as understand cost-effectiveness issues. Ethical and legal issues including genetic privacy are also addressed.
• In addition, residents can observe culture and harvest techniques for a variety of specimen types, metaphase preparation and staining, microscopy and imaging technology, and fluorescence in situ hybridization (FISH), and array comparative genomic hybridization (aCGH). Residents learn to assemble karyotypes using a CD-based tutorial. Assigned independent reading is required.
• In addition, each resident is required to write a disease summary that explores the cytogenetic basis of selected disorders, details testing methodologies and their limitations, and discusses implications for prognosis, when applicable. Disease summary topics are selected with the assistance of the supervising Senior Cytogeneticist. Self-
directed tutorials on selected cytogenetic topics are also offered.

- Cytogenetic studies and test results are correlated with anatomic and clinical pathology data on an ongoing basis throughout the residency education. The residents select tissues from tumors and from autopsy cases to be sent for cytogenetic testing, and the cytogenetic test results become part of formal reports or are included as addenda.
- During the rotation in the Women’s and Perinatal Division, the residents perform the fetal autopsies on many malformed fetuses with known or suspected chromosome anomalies. These matters are discussed as part of the review and sign out of each relevant case.
- With regard to Clinical Pathology, serum screening (for amniotic fluid AFP, uE3, and hCG) identifies pregnancies at-risk for aneuploidy, and the laboratory provides follow-up on these cases. Residents are invited to attend genetic counseling sessions during which patients are counseled regarding abnormal pathology and cytogenetic findings.
- Finally, for those residents interested in gaining additional experience in cytogenetics, the possibility of special projects may be explored.

A formal fellowship in Clinical Cytogenetics is available in the laboratory. This is a two-year program, accredited by the American Board of Medical Genetics, which requires one year of full time work in the clinical laboratory and one year of research. Fellows in this program participate actively in all components of the laboratory activities, including cell culture, cell harvest and slide preparation, microscope analysis of metaphase and interphase cells, utilization of FISH techniques, aCGH analysis, CAP proficiency testing, case review and sign out, teaching at conferences and assuming clinical pager duties.

The professional staff associated with the Cytogenetics Laboratory include Cynthia Morton, Ph.D., Frederick Bieber, Ph.D., Paola Dal Cin, Ph.D., Jonathan Fletcher, M.D., Anne Giersch, Ph.D., Charles Lee, Ph.D., Natalia Leach, Ph.D., Azra Ligon, Ph.D., Mary Sandstrom, Ph.D., Stanislawa Weremowicz, Ph.D., and Sheng Xiao, M.D.
PATHOLOGY INFORMATICS

Established in 2001, the Pathology Informatics Division at BWH uses information technology to improve clinical productivity, facilitate translational research and train the next generation of pathologists. The initial focus of the division was to select, purchase and implement a commercial anatomic pathology information system to replace an aging homegrown system. Dr. Frank Kuo was appointed Director in 2005 and has a staff that includes a full-time project manager, a systems analyst and a technical specialist. Since then, the group has been increasingly involved in system development and informatics research. In addition, the Path IT division aims to

- Support and develop the departmental web site
- Maintain and improve the departmental computing infrastructure
- Assist in the production of electronic presentations and other multimedia
- Participate in and initiate research and development efforts
- Provide bioinformatic and data analysis support for research projects
- Develop applications to support tissue banking activities
- Innovate tools for computer-assisted laboratory and structured pathology reporting

In collaboration with the pathology services at MGH, the Path IT implemented a pathology information system, Powerpath, in December of 2004. Since then, the Autopsy, Surgical Pathology, Women’s and Perinatal Pathology and Cytology Divisions, the Center for Advanced Molecular Diagnostics and selected areas of Clinical Laboratories have all issued patient reports exclusively with the system. Histology, immunohistochemistry, electron microscopy, molecular diagnostics, and flow cytometry laboratories also use the system to receive electronic orders from pathologists and manage workflow in the labs. Billing and compliance reviews are done real time and electronically using Powerpath. Cassette and slide label printers are directly controlled from the system. Digital gross photos and scanned paper requisitions are linked to individual cases and readily retrieved.

All pathology reports are issued via the main hospital computer, which also allows access to patient information including demographic data, discharge and operative reports, outpatient progress and consultation notes, scanned handwritten inpatient medical charts and nursing records, pharmacy records, surgical pathology results, laboratory values, and results of radiology and special diagnostic procedures (e.g., computed tomography, MRI, and echocardiography reports).

Computer Resources: The residents have access to more than 500 desktop computers located throughout the department. In the residents’ room, a workstation is on every resident’s desk, networked to printers and other resources. Partners applications, including clinical and laboratory information systems, Microsoft Office suite and internet access are standard on these workstations. Several microscopes equipped for digital photography are located in the residents’ room, the imaging room at the Medical Research Building and most signout areas. Portable LCD projectors and Partners-build laptop computers are available for digital presentations. The Pathology Conference Room is fully equipped to support electronic presentations. The state-of-the-art roof-mount projector and digital camera on the microscope support live microscopic sessions. Connections for Mac and PC laptops are available. A Partners-wide email system is available to all residents and fellows and can be accessed remotely. Network storage space is allotted to everyone and is regularly back up by
Path IT is actively engaged in the education and training of the next generation of pathologists to be proficient in the management and consumption of healthcare data. This includes one-on-one hands-on training, didactic teaching sessions, inviting speakers for seminars and creating opportunities for trainees to participate in active IT projects. An integrated clinical fellowship in Pathology Informatics & Imaging at the Partners Health System, initially based at the Massachusetts General Hospital, the Brigham and Women’s Hospital and the North Shore Medical Center, began in July 2009.

**Medical Literature:** Residents are frequently referred to the current medical literature and given key references by senior staff during sign-out of surgical and autopsy cases and in teaching conferences. Subspecialty pathologists are a particularly valuable resource for residents since they are up-to-date on the current clinical and research literature in their field and can critically discuss it with the residents. Collated collections of current articles and reviews are available in subspecialties. During the first two years of residency, residents prepare five Gross Micro presentations which require extensive review of the current clinical and investigative literature on a topic of their choosing. Residents run a monthly scientific journal club where each resident reviews recent article from selected basic research journals. Residents have access to multiple medical libraries, including the Countway Library of Medicine at Harvard Medical School, and the Brigham and Women's Hospital Medical Library (access 24 hours x 7 days). Library facilities are also available at the Children's Hospital, and the Office of the Chief Medical Examiner. Access to electronic on-line journals is also provided through the Harvard Medical School library system (eCommons Digital Library) and BWH library subscriptions. MEDLINE, HEALTHSTAR, AIDSLINE, and CANCERLIT databases are available on all the hospital system computers located throughout the department including residents' rooms and signout rooms.
KEY COMPETENCIES FOR PATHOLOGY RESIDENTS AND CLINICAL FELLOWS

The training programs of the Department of Pathology at the Brigham and Women’s Hospital emphasize the achievement of key competencies by its residents and clinical fellows. Objectives and approaches are summarized below for the six major areas of importance:

PATIENT CARE

Objectives:

- To gain diagnostic competence and the ability to provide appropriate and effective pathology services and clinical consultation.
- To learn to collaborate with other professionals, include those in other disciplines, in providing patient-focused care.
- To learn the principles of compassionate and cost-effective patient care.

Approach:

- Residents gather essential and accurate clinical information about the patients on whom they interpret lab tests, perform autopsies, or receive surgical or other tissue or fluid specimens, including discussion of history with clinical housestaff and/or attendings, detailed hospital chart review, preview of O.R. schedules and reports/slides of previous pathologic specimens or relative laboratory tests, and review of hospital charts and radiologic reports/films when applicable.
- Residents make informed decisions regarding additional diagnostic workup of patient specimens (special stains, deeper sections, molecular testing, flow cytometry, electron microscopy, etc.) based on patients' clinical history, up-to-date scientific evidence gleaned from journal articles, internet-based searches, textbooks, and clinical judgement.
- Residents use available information technology (hospital and laboratory information systems, electronic bibliographic searches and journals) to support workup and diagnosis, and to help educate clinicians by providing relevant literature references.
- Demonstrate competence in the performance of procedures considered essential for pathology practices, including:
  - Autopsy evisceration and dissection.
  - Intraoperative surgical pathology consultation (proper inking, sectioning/dissection, frozen section slide preparation).
  - Dissection and description of surgical pathology specimens.
  - Fine-needle aspiration
  - Dictation of gross descriptions.
  - Interpretation of laboratory results, including electrophoresis, flow cytometry, gross and microscopic pathology
  - Generation of accurate and clinically useful anatomic and clinical pathology reports, clinical consultations, and effective communication of results to clinicians.
  - Preparation and presentation at Department of Pathology and interdisciplinary clinical conferences.
  - Active participation in intraoperative consultations, including timely communication of results to surgeons.
MEDICAL KNOWLEDGE

Objectives:

• To gather and consolidate knowledge about established and evolving basic biological and clinical sciences and clinicopathologic correlations, and the application of this information to patient care and to pathology.
• To gain analytical and problem-solving skills and their application in pathology.

Approach:

• Residents demonstrate an investigatory and analytical thinking approach to clinical situations, including:
  − Development of reasonable and complete differential diagnoses for anatomic and clinical pathology cases based on the available clinical information, gross and microscopic features, laboratory test results, and current published information.
  − Suggesting appropriate additional testing (special stains, electron microscopy, flow cytometry, molecular diagnostics, etc.) if applicable.
  − Formulation of comprehensive and cohesive differential diagnoses and discussion of pathologic findings in final pathology reports.
  − Design and carry out research projects, such as clinicopathologic studies, or case reports with literature review.

• Residents know and apply the basic and clinically supportive sciences which are appropriate to the specialty of pathology, including:
  − Demonstration of knowledge of epidemiology of various diseases, and use of such knowledge to formulate pathologic diagnoses.
  − Demonstration of familiarity with the clinical presentations and manifestations of various diseases during discussion and workup of pathology cases, and and use of such knowledge to formulate pathologic diagnoses.
  − Demonstration of familiarity with advanced techniques, such as histochemical and immunologic stains, molecular diagnostics, cytogenetics, and flow cytometry, including biochemical, molecular, and immunologic principles, methods, and applications.
  − Demonstration of detailed knowledge of human anatomy, physiology and pathophysiology during dissection and description of anatomic pathology cases.
PRACTICE-BASED LEARNING AND IMPROVEMENT

Objectives:

- To gain the ability to evaluate and improve a diagnostic and consultative practice based on scientific evidence.
- To locate, appraise and use scientific data to improve patient care.
- To apply knowledge of rigorous scientific principles, study design and statistical methods to evaluate published clinical studies and do clinicopathologic investigation.
- To learn to use information technology to manage information and conduct personal continuing education.
- To facilitate the learning of students, residents, colleagues and other health care professionals.

Approach:

- Residents show the ability to analyze practice experience and perform practice-based improvement activities using a systematic methodology, including:
  - Active participation in weekly conferences, such as retrospective review of cases in surgical pathology, molecular diagnostics, and serum protein electrophoresis; evaluating reports for diagnostic and typographical errors, assessing for suboptimal slide or sample quality, and observation of quality control trends.
  - Active participation in Quality Assurance Committee, learning how to identify and report on a variety of QA monitors and conduct a CAP-checklist laboratory instruction.

- Residents show ability to locate, appraise, and assimilate evidence from scientific studies related to patients' health care problems, including:
  - Use of literature search and review to find relevant scientific references to aid in the workup of cases.
  - Obtain and use information about patient populations (via computer searches and medical records chart review) for clinicopathologic study of selected diseases.

- Residents are able to apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness, including:
  - Active participation in weekly conferences with critical discussion of study designs and statistical methods of presented articles.
  - Design and conduct their own clinical, translational and basic research studies.

- Residents demonstrate competency in the use of information technology to manage information, access on-line medical information, and support their own education, including:
  - Accessing of patient clinical information and previous pathology accessions and laboratory results via the hospital's Laboratory Information System.
  - Performance of computer bibliographic searches.
  - Maintenance of their own case volume statistics for autopsy and cytology FNA's.
– Show competence in the use of computer digital imaging technology.
– Accessing web-sites pertaining to specific diagnoses (grading systems for tumors, OMIM for genetic syndromes, etc.).

• Residents actively participate in the teaching of medical students and other health care professionals, including:
  – Teaching students on elective rotations in Pathology and in Medical school courses as laboratory instructors.
  – Teaching students and residents from other disciplines during in-hospital clinical conferences.

INTERPERSONAL AND COMMUNICATION SKILLS

Objectives:

• To acquire and use interpersonal and communication skills that result in effective information exchange and collaboration with other health care professionals and patients (and their families).
• To create and maintain an effective, ethically sound and respectful relationship with peers, other health care professionals, and patients (and their families).
• To use effective listening skills.
• To work effectively with other professional and non-professional staff.

Approach:

• Residents demonstrate effective listening skills, elicit, and provide information using effective nonverbal, explanatory, questioning and writing skills. This includes:
  – Following instructions from attending pathologists during performance of intraoperative consultations, autopsy and surgical specimen dissection and gross description, discussion of laboratory “beeper calls,” and during signout of cases.
  – Demonstrating interest in pathology case material during case signout by asking relevant questions, and responding articulately to questions from attending pathologists.
  – Eliciting relevant clinical information from, and providing preliminary diagnostic information to, clinicians via telephone/email conversations for consultations.
  – Generating concise, accurate, and complete dictated gross descriptions and written microscopic descriptions/diagnoses of cases in preparation for case signout with attending pathologists.
  – Generating concise, accurate, and complete consultations in the clinical laboratories.
  – Effectively prepare and deliver case presentations to various intra- and extradepartmental audiences.
  – During senior years of residence training, serve as an effective teacher for the junior pathology housestaff.
  – Demonstrating effective oral and written communication skills in reports and research projects.
Residents should work effectively with others as a member or leader of health care team or other professional group, including:
- Preparation and presentation of cases with medical residents during weekly Medical Mortality and Morbidity and other Conferences.
- Participation with other members of the Dept. of Pathology and Laboratory Medicine and other departments on various hospital committees.

PROFESSIONALISM

Objectives:

- To maintain a commitment to excellence in carrying out professional responsibilities, adherence to ethical principles, and sensitivity to diversity in the workplace.
- To maintain respect, compassion and integrity; responsiveness to patients that supercedes self-interest; accountability to patients, colleagues, and the profession and discipline of pathology; and a commitment to on-going professional development.
- To develop and maintain a commitment to confidentiality of patient information, informed consent and ethical business practices.
- To learn the highest principles relating to conflict of interest and commitment.
- To develop the maximum sensitivity to colleague and patient ethnicity, age, gender and disabilities.

Approach:

- Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population, including:
  - Showing respect, compassion, and integrity during performance of autopsies on patients, including gentle, respectful handling of the body and maintenance of modesty for the deceased.
  - Showing responsiveness and accountability to the needs of patients and their families and clinicians that supercedes self-interest, including contributions to the timely completion of case review and pathology reports, and discussion of results with clinicians.
  - Demonstrating commitment to excellence and ongoing professional development, such as completing directed and independent reading from pathology textbooks and journal articles during anatomic and clinical pathology rotations, designing and completing research projects, undertaking literature searches on various pathology topics, providing high-quality presentations at conferences, and attending in-house and off-site pathology lectures and conferences.
  - Demonstrating a commitment to ethical principles pertaining to confidentiality of patient information acquired during handling of case materials.
  - Demonstrating commitment to ethical principles pertaining to business practices, including helping to ensure accurate billing for services.
  - Demonstrating adherence to the highest principles of mutual respect of colleagues and support personnel.
SYSTEMS-BASED PRACTICE

Objectives:

- To develop an awareness of and responsiveness to the larger context and system of health care and the ability to access and effectively use resources to provide value-added pathology services.
- To understand how pathology services affects other health care professionals, organizations and systems.
- To develop an understanding of the principles of cost-effective health care and resource allocation that enhances (and does not compromise) quality of service and patient care.

Approach:

- Residents must demonstrate an awareness of, and responsiveness to, the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. This includes:
  - Understanding how their handling of specimens affects other health care professionals, the health care organization and the larger society, including making accurate diagnoses with efficient use of routine and specialized testing, achieving rapid turnaround time for pathology reports, timely communication of results to clinicians in order to expedite patient discharge from the hospital, and establishing accurate diagnoses of epidemiologically important diseases.
  - Knowing the differences between various medical practice and health care delivery systems (fee-for-service, discounted fee-for-service, capitated systems, etc), and how they affect the practice of pathology and laboratory medicine.
  - Demonstrating knowledge of methods for controlling health care costs and allocation of resources.
  - Practicing cost-effective health care and resource allocation that does not compromise the quality of care, including judicious, cost-conscious ordering of special stains and ancillary lab studies.
  - Demonstrating knowledge of how to collaborate with health care managers and health care providers to assess, coordinate, and improve health care, and knowledge of how these activities can affect system performance.
EVENING AND WEEKEND CALL

Evening and weekend call at BWH for AP is taken by second year residents. The AP residents cover frozen sections at night and on weekends and autopsies on holiday weekends (see below). CP call on nights and weekends is divided between the Hematology/Chemistry/Microbiology residents, who rotate responsibility for consultations involving those clinical laboratories, and the Blood Bank residents, fellows, and faculty, who share coverage for the Blood Bank calls. Backup to and supervision of all residents on call is provided by both fellows and senior staff.

Autopsy: The autopsy rotation is defined as Monday through Saturday. Autopsies are typically not performed on Sundays except for three-day weekends in which case a second-year resident covers Sundays and autopsies are not performed on the Monday holiday. Each second year resident covers autopsy one holiday weekend per year. Full senior staff supervision of autopsies is provided on weekends identical to that during the week.

Frozen Sections: The frozen section room is continually staffed by an on-call resident and senior pathologist. Evening call is covered by a second-year resident assigned to a surgical subspecialty rotation on a rotating basis according to a formal monthly schedule. This coverage involves approximately 28-30 nights per second-year resident per year in which the resident stays in the hospital late until all surgeries requiring a frozen section are completed. Only rarely (i.e. one time per month) is the resident on call required to return to the hospital at night for an unexpected frozen section. The resident covers general surgical pathology as well as subspecialty areas such as gynecologic pathology and neuropathology. Backup is provided by separate senior staff in general pathology, gynecologic pathology and neuropathology according to the monthly schedule. The staff pathologist is present at the time the frozen section is interpreted and provides feedback. Weekend call for frozen sections is covered by second-year residents and averages 6 weekend calls per year.

Chief Resident/Senior Resident on Surgical Pathology (SRSP): Chief Resident/SRSP or their designees are on call at all times as backup for junior residents and to handle miscellaneous questions which may arise from inside or outside the pathology department. The Chief Resident and SRSP are also on call to the frozen section room during designated hours during the week, supervising the residents and deciding on a diagnosis before interpretation by the staff pathologist.

Affiliated Institutions: Residents rotating at Children's Hospital (all PGY 2) take evening and weekend call covering surgical pathology (including frozen sections) and autopsy pathology. Residents rotating at the Medical Examiner's Office do not take evening or weekend call.

Clinical Pathology: For chemistry, hematology and microbiology, the resident on the service holds the relevant pager from 8 a.m. to 5 p.m. From 5 p.m. to 8 a.m. and on weekends, a PGY2 resident takes pager call from home a week at a time. Each resident this year will cover 12 weeks of CP call. Blood Bank/Transfusion Medicine is covered by beeper call from home shared by the resident(s) on that service, Transfusion Medicine fellow, and moonlighters according to a predetermined schedule. Chief Residents and faculty are always available for consultation and all beeper calls are reviewed weekly with the faculty.
TRAINEE DUTY HOURS

The ACGME’s common requirements for limiting resident/fellow duty hours effective July 1, 2011 have the following provisions:

- Residents and clinical fellows **must not work more than 80 duty hours per week**, averaged over a four-week period;
- **One day in seven must be free of all patient care responsibilities**, averaged over a four-week period;
- **Duty periods of PGY-1 residents must not exceed 16 hours.**
- **Residents should have 10 hours, and must have eight hours, free of duty between scheduled duty periods;**
- When residents take call from home and are called into the hospital, the time spent in the hospital must be counted toward the weekly duty hour limit but does **NOT count against the time off between shifts by initiating an new off-duty period**;
- Time spent in patient care activities external to the educational program ("moonlighting") should be counted toward the weekly duty hour limit; and
- **Programs and their sponsoring institutions are required to have policies and procedures to monitor and support the physical and emotional well-being of residents.**

The Department of Pathology intends to comply with these rules both in spirit and to the letter. The potential financial and other penalties to the program and to the institution for violations are substantial, and trainee duty hours are monitored by the hospital. Partners and BWH take these rules very seriously. Residents complete a duty hours survey from the Brigham GME Office monthly and log their duty hours four months/year.

**ACTIVITIES THAT COUNT**

- Clinical work, in the hospital or elsewhere (as assigned)
- Required on-site educational activities, such as conferences, Grand Rounds, meetings, etc.
- Moonlighting at BWH or any other institution
- Time spent in the hospital, once called in from home.

**ACTIVITIES THAT DON’T COUNT**

- Taking call from home (e.g., weeknights, weekends)*
- Commuting, daily or when calling in from home (as in answering a page)
- “Voluntary” time in the hospital: using the medical library after a shift, sleeping in the hospital when the trainee could otherwise go home, doing academic work (including preparation for conferences) in the hospital by choice, reading, working on research projects.

*Call taken from home is not counted toward the hourly workweek limit, but cannot be considered a “day off”.

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DEPARTMENTAL ACADEMIC PROGRAMS

CONFERENCES

There is a rich and well-organized schedule of interdepartmental and departmental teaching sessions including Grand Rounds, surgical pathology, clinical pathology and basic research conferences. Most conferences are held at 8:00 am, noon or 1:00 pm which are the times during the resident's day that they are most able to attend.

AP Summer Teaching Conferences held 4 days/week from July through mid-October comprise our core topics lecture series. These conferences, given primarily by BWH faculty, cover all aspects of how to function as a pathologist (including gross descriptions, histology, frozen sections, special stains and other ancillary tests, photography, the computer system, etc.) as well as introductory lectures on the pathology of various organ systems. CP Summer Teaching Conferences are held 4 days/week from July to September and comprise the core topics in CP - including the topics in clinical chemistry, microbiology, hematology, molecular diagnostics, and blood bank/transfusion medicine.

At the end of September/beginning of October, our regular academic year conference schedule begins which includes interdepartmental and departmental teaching sessions including Grand Rounds, surgical pathology, clinical pathology and basic research conferences. The major departmental conferences include:

Gross-Micro Conference (weekly)

This conference is composed of 20-minute presentations by residents that begin with a case presentation of one to five minutes and then either delve into recent research findings that elucidate mechanisms of disease or elucidate diagnostic criteria or a new treatment modality related to the case. Examples of presentations include hemochromatosis, familial breast cancer genes, the retinoic acid receptor in acute promyelocytic leukemia, the genetic basis of familial atrial septal defects, cardiac transplant graft arteriosclerosis, the cyclins in cell cycle regulation, intracellular signaling in control of cell size, and skin stem cells. In many ways, the approach of this conference epitomizes the approach of the department toward the discipline of pathology in general. Presentations attempt to bring together information from the clinical case, diagnostic pathology, and the latest research, in order to obtain a truly complete picture of the disease. During the first two years, each resident will give approximately 5 of these conferences.

Pathology Grand Rounds (weekly)

Senior faculty members from Harvard, other Boston institutions and invited nationally and internationally known experts present state-of-the-art lectures on evolving clinical/diagnostic issues or basic scientific topics that link pathogenesis to the clinical expression of disease. This is a joint conference with the Beth Israel Deaconess Medical Center and Children's Hospital Departments of Pathology.
Surgical Pathology Update (weekly)

Faculty members from the department and other Boston teaching hospitals, as well as invited national experts, present lectures or slide seminars on topics of current or evolving interest in the field of diagnostic anatomic pathology and related research.

Clinical Pathology Conference (weekly)

Senior faculty and other invited speakers from other departments and institutions review a variety of aspects of laboratory medicine, including management considerations. These are directed specifically towards resident teaching and attempt to cover a large part of the core curriculum.

General Residency Teaching Conference (weekly)

Primarily targeted to AP/CP or CP residents in their clinical pathology core year and to senior AP residents and interested fellows. Faculty present topics with a focus on board relevance. This conference includes a series of lectures on pathology informatics, laboratory management, and career development.

Women’s and Perinatal/Cytopathology Conference (weekly)

This conference consists of several components, including didactic review of obstetrical and gynecologic diseases by the faculty of the Women’s and Perinatal Division, case review and interactive teaching using the Classroom Performance System, review of perinatal/fetal autopsy cases, and presentation of abstracts by residents and fellows prior to national meetings. The third week of each month is devoted to topics in Cytology under the direction of the Cytology Division. Typically, all first and second year residents (and others) attend these conferences.

Gross Conference (thrice weekly)

Residents present their recent autopsy findings to pathology faculty, residents and students. Presentations typically include a 2 or 3 minute history, examination of pertinent radiographs (with the assistance of a radiology resident assigned to the conference), and examination of gross pathology, often with some microscopic correlation. A typical presentation, including discussion, lasts 5 to 15 minutes, depending on the complexity of the case. Clinicians frequently attend presentations of patients from their services.

Cytology Case Conference (weekly)

Residents and staff meet to review challenging cases in the cytology signout room.

Papanicolaou Smear/Biopsy Conference (weekly)

Residents and staff meet to review discrepancies between cervical cytologic smears and biopsies for quality assurance.
Clinical Pathology Call Conference (weekly)

Residents in CP rotations present interesting cases and questions received from clinicians to fellow residents and attendings for feedback and teaching.

Women’s and Perinatal Diagnostic Conference (weekly)

In this conference, challenging cases selected by the staff, residents and fellows of the Women’s and Perinatal Division are presented at the 14 head microscope. In this combination of teaching and working conference, cases are triaged and the results of the discussion recorded by the Fellow for future reference. Typically, residents rotating on the Women’s and Perinatal service attend this conference.

Gynecologic Oncology Tumor Conference (weekly)

In this weekly interdisciplinary conference, all gynecologic tumor cases are presented by the Women’s and Perinatal Fellow. Typically, residents rotating on the Women’s and Perinatal service will attend this conference.

Medicine/Pathology Clinicopathologic Conference (CPC) (bi-weekly)

Case based discussion in clinicopathologic format by internal medicine faculty member with pathology presentation and correlation by pathology faculty.

Radiology Conference (bi-weekly)

At this conference, the radiologist and pathologist work together to find cases of interest to radiology house staff. Three to 4 cases are usually presented; the pathologist's presentation is typically 1 to 2 minutes per case, with emphasis on gross pathology. Typically, a resident will present 2 or 3 of these conferences a year.
# Representative Weekly Conference Schedule

**Monday**
- 8:00 am  Autopsy Conference
- 8:00 am  Sarcoma Clinic Working Conference
- 12:15 pm  Radiology Pathology Conference
- 12:30 pm  Pathology Grand Rounds

**Tuesday**
- 8:00 am  Dana Farber Oncology Pathology Conference
- 12:00 pm  Women’s and Perinatal Diagnostic Conference
- 12:00 pm  Liver Pathology Conference (1st Tuesday)
- 12:00 pm  IBD Working Conference (2nd and 4th Tuesday)
- 1:00 pm  Surgical Pathology Teaching Conference
- 2:10 pm  Surgical Pathology Gross Conference
- 2:30 pm  Brain Cutting
- 3:00 pm  Multidisciplinary Interstitial Lung Disease Conference

**Wednesday**
- 7:15 am  Joint Thoracic Surgery/Radiology/Pathology Conference
- 7:30 am  GYN Tumor Board
- 8:00 am  Autopsy Conference
- 8:00 am  General Residency Teaching Conference
- 8:00 am  Uroradiology Conference
- 12:00 pm  Medicine/Pathology Clinicopathologic Conference
- 12:00 pm  GI CPC (3rd Wednesday)
- 1:00 pm  Women’s and Perinatal Pathology/Cytopathology Conference
- 2:00 pm  Cytogenetics Laboratory Conference
- 2:10 pm  Surgical Pathology Gross Conference
- 4:00 pm  Cytology Diagnostic Conference

**Thursday**
- 8:00 am  Gross-Micro Conference
- 12:30 pm  Papanicolaou Smear/Biopsy Conference
- 1:00 pm  Clinical Pathology Conference
- 2:00 pm  Microbiology Plate Rounds
- 2:00 pm  Hematopathology AP/CP Conference
- 4:30 pm  Seminars in Vascular Biology

**Friday**
- 7:30 am  Neurology/Neuropathology Conference
- 8:00 am  Pathology Subspecialty Teaching Conference
- 9:15 am  Autopsy Conference
- 11:15 am  GI Pathology Interesting Case Conference
- 11:45 am  Neuro-Oncology/Brain Tumor Board
- 12:00 pm  Women's and Perinatal Diagnostic Conference
- 12:30 pm  Clinical Pathology Call Conference
- 1:00 pm  Surgical Pathology Update
- 2:10 pm  Surgical Pathology Gross Conference
RESEARCH OPPORTUNITIES

Several large Research Programs represent the coalescence of individual research labs organized along principles of shared interests, focus, equipment, and geography. In many cases, these constitute actual Departmental Divisions. The Faculty and Trainees of these Programs not only write combined grant proposals and share core resources, but also participate in joint laboratory meetings and seminars, and enjoy mutual social events. They include:

- **Vascular Biology**
- **Immunology**
- **Translational Cancer Pathology**
- **Neuropathology**
- **Women’s and Perinatal Pathology**
- **Molecular Genetics**
- **Structural Molecular Pathology**
- **Dermatopathology**

Translational research emphases include the application of cutting edge analytical, genomic, proteomic and imaging technologies to identify and exploit biomarkers and other molecular targets for the diagnosis and therapeutic treatment of major human cancers and cardiovascular and other diseases. Research Career development is discussed later in more detail.

**Representative Research Interests of Pathology Faculty:**

- **Jon Aster** Molecular oncology
- **Frederick Bieber** Genetics of development, hearing disorders
- **Steven Blacklow** Structural biology of protein folding and ligand-receptor interactions
- **Edmund Cibas** Flow cytometry, cytology, molecular diagnostics, informatics and quality assurance
- **Christopher Crum** Molecular pathology of vulvar and cervical cancer, including human papilloma viruses
- **Umberto De Girolami** Neuropathology and ophthalmic pathology of AIDS; neuromuscular pathology
- **Mel Feany** Molecular biology of CNS degenerative disease
- **Jonathan Fletcher** Cytogenetics of human tumors
- **Rebecca Folkerth** Developmental neurobiology
- **Christopher French** Epithelial cancer biology
- **Michael Gimbrone** Pathophysiology of vascular endothelium, adhesion molecules, atherosclerosis
- **John Godleski** Pulmonary injury, macrophage function
- **Petr Jarolim** Transfusion medicine, hematology, hereditary hemolytic anemias
- **Lester Kobzik** Pulmonary macrophage biology
- **Andrew Lichtman** Transcriptional control of cytokines, endothelium-lymphocyte interaction
- **Keith Ligon** Molecular biology of brain tumors
- **Massimo Loda** Subcellular mechanisms in carcinogenesis
- **William Luscinskas** Vascular pathobiology
Richard Mitchell  Transplant pathology, cardiovascular immunopathology,
Cynthia Morton  Molecular cytogenetics, uterine fibroids, hereditary deafness
George Murphy  Cellular and molecular mechanisms of cutaneous inflammation
George Mutter  Developmental genetics, genetics of ovarian and endometrial cancer
Marisa Nucci  Uterine mesenchymal tumors, vulvovaginal soft tissue tumors, ovarian neoplasia
Helmut Rennke  Pathophysiology of glomerular disease
Frederick Schoen  Valvular heart disease, medical device pathology, tissue engineering
Arlene Sharpe  Molecular immunology; Director, BWH Transgenic Facility
Stanislawa Weremowicz  Molecular cytogenetics, gene mapping

RESEARCH CAREER DEVELOPMENT IN LABORATORY INVESTIGATION

INTRODUCTION

In addition to the clinical and educational elements of the BWH Department of Pathology, research training and career development is an integral component of our Residency and Fellowship program. Beyond M.D. and M.D.-Ph.D. Residents and Fellows, the Department is also home to the research training and mentoring of M.D., M.D.-Ph.D., and Ph.D. Post-doctoral Fellows who are not engaged in any clinical training during their BWH tenure. The overarching goal is to provide broad opportunities to explore options across the research spectrum from purely clinical through translational and basic science. Moreover, beyond the individual trainee-PI relationship, the Department seeks to provide a mindset and supportive framework of time, information, and direction that allows our trainees to flourish and succeed in a competitive research environment. Mentorship and role models are central component in this process.

The Training Program encompasses both a formal entity with T32 support (Director: Dr. Michael Gimbrone and Co-Director: Dr. Richard Mitchell), as well as a network of Pathology Department laboratories with a shared training mission and individual funding support. It is intended to accommodate M.D. and M.D.-Ph.D. Pathology Residents and Clinical Fellows who anticipate careers primarily focused in basic science, as well as those who wish to develop careers at the interface of clinical-translational research or industry. Training and mentoring process is designed to promote the development of Ph.D. Post-doctoral Fellows in careers that more broadly engage clinical and translational problems related to human disease pathophysiology and pathogenesis.

ORGANIZATION

Involvement with the Training Program begins with the initial recruitment process. Thus, clinical trainees typically initiate the interactions with potential research supervisors to discuss research opportunities based on specific interests. For such Residents and Fellows transitioning to post-doctoral research, a Departmental database of laboratory opportunities facilitates matchmaking with labs and Principal Investigators. The Director or co-Director of the Training Program also insure that laboratory or departmental funding is available to support research positions, and meet regularly with Residents and Post-doctoral Research Fellows to assess progress and help direct next steps in career development. In comparison, the non-clinical research Post-
doctoral Fellows are invited by individual Principal Investigators and participate in an interview process designed to connect them with a variety of potential mentors within the BWH Pathology Department, as well as the broader BWH and Harvard Medical School biomedical scientific community. The actual selection process takes into account a number of factors related to applicants’ academic credentials, potential interests, and “fit” with the Training Program goals, as well as a deliberate emphasis on fostering Program diversity and excellence.

Throughout clinical training (for Residents and Fellows) or post-doctoral training (for Ph.D. Fellows), regular opportunities to meet with other post-docs, junior and senior pathology faculty, clinical-translational faculty, and even industrial contacts take the form of clinical conferences, research seminars, journal clubs, and informal get-togethers. Residents in Pathology are encouraged to use their annual allocation of independent study time to explore research-related opportunities with either translational or basic science research faculty. Conversely, basic research Fellows also participate in regular Departmental conferences, and where appropriate, mentored clinical experiences. Through these interactions trainees identify role models who practically illustrate how research and clinical practice can be successfully combined.

Trainees are also apprised of the broader research and educational opportunities proximate to BWH, including Harvard Medical School, MIT, the combined Harvard-MIT Division of Health Sciences and Technology, the Leder Harvard Biology and Translational Medicine (HBTM) program, the Center for Integration of Medicine and Innovative Technology (CIMIT), and the Brigham Research Institute (BRI). The ability to capitalize on the wealth of interdisciplinary conferences and research seminars within and without the BWH Pathology Department is limited only by trainee time constraints and interests. Less formal, but equally important are direct interactions between Post-doctoral Fellows and Resident Trainees. Post-doctoral Fellows are important parts of the mentoring community for Residents at earlier stages of training; conversely, Residents provide an early, peer-level connection for Post-doctoral Ph.D.’s to clinically-relevant training experiences. Consequently, regular cross-fertilization in conferences, journal clubs, and informal get-togethers are important elements of the training program.

As research trainees prepare to transition to independent support, they are apprised of the mechanisms of the various funding opportunities (e.g., K versus R versus other forms of outside support), as well as the diversity of opportunities: clinical-translational, industry, basic research, or some combination of clinical service activities and research. Fellows and Junior Faculty who have previously successfully negotiated a particular path are also connected to the transitioning Trainees to provide insight and practical logistical information. The Director or Co-Director of the Training Program, along with the various research faculty are key resources for reading and critiquing grant proposals, as well as navigating the administrative details of the grant submission process. At the same time, the Director and Co-Director are also proactive in promoting the awareness of individual trainees for specific funding opportunities and awards, and are resources for coordinating letters of recommendation and support.

**DEPARTMENTAL RESEARCH MENTORING**

Although a trainee’s research preceptor has a major responsibility for mentoring in proper experimental design, data analysis, and issues of scientific conduct and integrity, the BWH Pathology Department believes that the career development of trainees benefits from additional Program-wide mentoring experiences. While the Program Training Faculty are the primary, active mentors of trainees, mentoring also frequently occurs on an informal basis.
The BWH Pathology Department has a strong culture and long history of mentorship flowing from a committed Directorship and extending from Senior Faculty through to Fellows, Residents, and Students. There is a very low turn-over within the BWH Pathology Faculty, and because the Senior and Junior ranks are well-populated with individuals who “grew up” in the culture of the Department, there is an impressive commitment to sharing the ethic and paying forward the benefits of what has been shared and conveyed at each level of training. This is represented not only in the general ethos of the Department, but also in concrete ways. For example, Residents and other Trainees are systematically guided in developing research projects and coached in their intra- and extra-departmental presentations; this, in turn, is reflected in the BWH Pathology Department consistently ranking in the top three programs in the world in representation by junior level members on platform sessions at the annual meeting of United States and Canadian Association of Pathology (USCAP), the largest such pathology society in the world. Moreover, the strength of this intradepartmental mentorship allows trainees the latitude and confidence to potentially select smaller labs of more junior Faculty in which to work, comfortable in the knowledge that there is a broader and hierarchical support structure that will assure them access to the same level of training and guidance as with a more-established investigator. Besides ad hoc mentorship of Junior Faculty within the T32 Training Program regular, systematic training of Junior Faculty, and their ability to mentor trainees, is also provided by ongoing access to the numerous Departmental, and Harvard Medical School-wide structured resources, in addition to BWH-sponsored programs.

Trainees at all levels within the Department also have access to a diverse menu of support and educational opportunities within the Hospital, Harvard Medical School, and across the greater Boston biomedical research community including a comprehensive BWH-sponsored Research Career Development seminar and workshop series, including topics on publications, grantsmanship, lab management skills, and balancing career and family. These offerings feature speakers drawn from a wide range of senior HMS scientists and those who are highly successful at securing sponsored funding.

One of the additional strengths of the BWH Program is that trainees are part of the greater HMS academic community. They are encouraged to attend specific courses that interest them, and/or are relevant to their research area at Harvard Medical School and the Harvard School of Public Health. Trainees in the program are also actively encouraged—as appropriate—to avail themselves of the deep and diverse resources of these various institutions, which provide an impressive and extensive assortment of elective seminars, training workshops, and conferences.

**NIH Institutional Training Grant**

The BWH Department of Pathology has received continuous NIH support from the National Heart, Lung, and Blood Institute for postdoctoral-level research training for over 50 years. The programmatic emphasis is on understanding the basic pathogenic mechanisms underlying major disease processes that affect the cardiovascular, pulmonary, hematopoietic, and immune systems, through the application of multidisciplinary research tools and strategies of modern cellular and molecular biology, immunology, genetics and genomics, integrative physiology, and bioinformatics. The NIH Institutional Training Grant (T32 HL007627) entitled “Vascular Pulmonary and Renal Injury” currently under the directorship of Dr. Michael Gimbrone, supports twelve slots including M.D., M.D.-Ph.D., and Ph.D. trainees, and has been the launching pad for a number of illustrious careers in academic pathology. The program counts 6 Pew Scholars, 7
awardees of Warner Lambert-Parke Davis Awards from the ASIP, a Lucille P. Markey Scholar, and several inductees to the National Academy of Science, the Institute of Medicine, the American Society for Clinical Investigation, the American Association of Physicians, and the American Association for the Advancement of Science among its graduates. Although the Core Faculty is comprised primarily of clinician-scientists and basic biomedical researchers in the BWH Department of Pathology, trainees are also encouraged to explore a wide spectrum of opportunities afforded by research mentors and laboratories across the entire family of Harvard-affiliated medical, academic, and research institutions.

A key set of opportunities for and an important metric of success of research career trainees is embodied in the highly competitive individual NIH Career Development Awards. The following lists summarizes residents in AP, CP or AP-CP who have obtained these mentored research grants in recent years (12 active in the Department) and other recent mentored research fellowships.
<table>
<thead>
<tr>
<th>NAME</th>
<th>RESIDENCY/FELLOWSHIP TRAINING PERIOD</th>
<th>GRANT AWARD/ FUNDING PERIOD</th>
<th>CURRENT POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derek Abbott, M.D., Ph.D.</td>
<td>AP 2000-2002</td>
<td>K08AI053819: RIP2 kinase's function in Innate Immunity, 2004-2008</td>
<td>Assistant Professor of Pathology, Case Western Reserve University</td>
</tr>
<tr>
<td>Maria Pilar Alonso Alcaide, Ph.D.</td>
<td>Postdoctoral Fellowship 2005-2008</td>
<td>K99/R01HL094706: Endothelial regulation of IL17 producing T effector cell migration, 2009-2014</td>
<td>Assistant Professor, Molecular Cardiology Research Center, Tufts Medical Center</td>
</tr>
<tr>
<td>Robert Blelloch, M.D.,</td>
<td>CP 2001-2004</td>
<td>K08NS048118: Determinants of Neural and Embryonic Stem Cell Potency, 2005-2010</td>
<td>Assistant Professor, University of California, San Francisco</td>
</tr>
<tr>
<td>Manfred Brigl, M.D.</td>
<td>CP 2005-2008</td>
<td>K08AI077795: CD1d-restricted NKT cells in microbial infection, 2008-2013</td>
<td>Assistant Professor of Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Kim Brown, Ph.D.</td>
<td>Postdoctoral Fellowship</td>
<td>K99/R00 ES018892: Effects of environmental estrogen exposure on spontaneous copy number variation</td>
<td>Assistant Professor of Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Lynn Bry, M.D., Ph.D.</td>
<td>CP 1998-2003</td>
<td>K08AI051734: Role of T cells in self-limited mucosal infections, 2003-2008</td>
<td>Assistant Professor of Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Jennifer Chan, M.D.</td>
<td>AP 1998-2000; Neuropathology Fellowship 2000-2002</td>
<td>K08HD048595: Proteoglycans Modulate Sonic Hedgehog Responses, 2005-2006</td>
<td>Assistant Professor of Pathology and Laboratory Medicine, University of Calgary</td>
</tr>
<tr>
<td>Eleanor Chen, M.D., Ph.D.</td>
<td>AP 2006-2010</td>
<td>St. Baldrick's Foundation Scholar: Identification of novel drug targets for embryonal rhabdomyosarcoma 2012-2105</td>
<td>Instructor in Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Xavier Cullere, Ph.D.</td>
<td>Postdoctoral Fellowship 1999-2006</td>
<td>K01AR054984: DOCK4 regulation of small GTPases in vascular permeability, 2007-2012</td>
<td>Instructor in Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>NAME</td>
<td>RESIDENCY/FELLOWSHIP TRAINING PERIOD</td>
<td>GRANT AWARD/ FUNDING PERIOD</td>
<td>CURRENT POSITION</td>
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<tr>
<td>Ronny Drapkin, M.D., Ph.D.</td>
<td>AP 1998-2001</td>
<td>K08CA10874: BACH1 Function in DNA Repair and Mammary Oncogenesis, 2005-2010</td>
<td>Assistant Professor of Pathology, Brigham and Women’s Hospital</td>
</tr>
<tr>
<td>Ron Firestein, M.D., Ph.D.</td>
<td>AP 2002-2004; Molecular Genetic Pathology 2004-2005</td>
<td>K08CA134836: CDK8: A Novel Colon Cancer Oncogene that Regulates Beta-catenin, 2008-2009</td>
<td>Scientist, Genentech, South San Francisco, CA</td>
</tr>
<tr>
<td>Christopher French, M.D.</td>
<td>AP 1995-1998; Cytopathology 1998-2001</td>
<td>K08CA092158: T(15;19) in Aggressive Pediatric Carcinoma, 2002-2007</td>
<td>Assistant Professor of Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Joel Henderson, M.D., Ph.D.</td>
<td>AP 2000-2003; Renal Pathology 2003-2004</td>
<td>K08DK073091: Actomyosin-Based Podocyte Contractility and Glomerular Pathobiology, 2008-2013</td>
<td>Assistant Professor of Pathology, Boston University Medical School</td>
</tr>
<tr>
<td>John Higgins, M.D.</td>
<td>CP 2005-2008</td>
<td>K08DK083242: Quantitative Analysis of Blood Flow in Sickle Cell Disease, 2008-2013</td>
<td>Assistant Professor of Systems Biology, Massachusetts General Hospital</td>
</tr>
<tr>
<td>Samuel Katz, M.D., Ph.D.</td>
<td>AP 2004-2006; Hematopathology 2006-2007</td>
<td>K08HL103847: Cell death regulation by pro-apoptotic bok during hematopoiesis, 2010-2015</td>
<td>Assistant Professor, Yale University</td>
</tr>
<tr>
<td>Keith Ligon, M.D., Ph.D.</td>
<td>AP 1997-1999; Neuropathology 1999-2001</td>
<td>K08NS047213: Olig function in CNS development and tumorigenesis, 2004-2009</td>
<td>Assistant Professor of Pathology, Brigham and Women’s Hospital/Dana-Farber Cancer Institute</td>
</tr>
<tr>
<td>David Lombard, M.D., Ph.D.</td>
<td>AP 2001-2003</td>
<td>K08AG022325: Sir2 in stress resistance, aging, and DNA repair, 2004-2009</td>
<td>Assistant Professor of Pathology, University of Michigan</td>
</tr>
<tr>
<td>John C. Luckey, M.D., Ph.D.</td>
<td>CP 2001-2004; Transfusion Medicine 2004-2005</td>
<td>K08AI063386: The Role of FcGamma-Rllb in Memory T cell self-renewal, 2005-2009</td>
<td>Assistant Professor of Pathology, Brigham and Women's Hospital</td>
</tr>
<tr>
<td>Danny Milner M.D.</td>
<td>AP/CP 2000-2004; Medical Microbiology 2004-2005</td>
<td>K23AI072033: Genetic Diversity of Plasmodium falciparum and Severe Malaria in Africa, 2007-2012</td>
<td>Assistant Professor of Pathology, Brigham and Women’s Hospital</td>
</tr>
<tr>
<td>NAME</td>
<td>RESIDENCY/FELLOWSHIP TRAINING PERIOD</td>
<td>GRANT AWARD/ FUNDING PERIOD</td>
<td>CURRENT POSITION</td>
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<tr>
<td>Nima Mossamaparast, M.D., Ph.D</td>
<td>CP 2006-2009</td>
<td>K08CA158133: Linking histone demethylation and the DNA damage response, 2011-2016</td>
<td>Assistant Professor of Pathology, Washington University in St. Louis</td>
</tr>
<tr>
<td>Scott Oakes, M.D.</td>
<td>AP 1998-2000</td>
<td>K08AI054650: BAX/BAK control ER-mitochondria apoptotic crosstalk, 2003-2008</td>
<td>Assistant Professor of Pathology, University of California, San Francisco</td>
</tr>
<tr>
<td>Eric Snyder, M.D., Ph.D.</td>
<td>AP 2005-2008; Molecular Oncology Fellow 2009</td>
<td>K08CA154784: The role of Nkx2-1 in lung adenocarcinoma, 2011-2016</td>
<td>Instructor in Pathology, Brigham and Women’s Hospital</td>
</tr>
<tr>
<td>Astrid Weins, M.D., Ph.D.</td>
<td>AP 2008-2010, Renal Fellow 2011</td>
<td>K08DK093783: Senescence and autophagy as mediators of glomerular injury in diabetes, 2012-2016</td>
<td>Instructor in Pathology, Brigham and Women’s Hospital</td>
</tr>
</tbody>
</table>
# 2012-2013 Department of Pathology Resident Research Fellowship Participation on NIH T32 Grant

<table>
<thead>
<tr>
<th>NAME</th>
<th>RESIDENCY/FELLOWSHIP TRAINING PERIOD</th>
<th>RESEARCH PERIOD</th>
<th>RESEARCH TOPIC (MENTOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georg Gerber, M.D., Ph.D.</td>
<td>CP 2010-2012</td>
<td>2012-present</td>
<td>Inferring dynamic signatures of microbes in complex host ecosystems (Lynn Bry, Brigham and Women’s Hospital)</td>
</tr>
<tr>
<td>Adrianna Zara Herskovits, M.D., Ph.D.</td>
<td>CP 2007-2010</td>
<td>2010-present</td>
<td>The Role of Sirtuin 1 Deacetylase in Amyotrophic Lateral Sclerosis (Leonard Guarente, MIT)</td>
</tr>
<tr>
<td>Scott Lovitch, M.D., Ph.D.</td>
<td>AP 2007-2009; Hematopathology 2009-2010</td>
<td>2010-present</td>
<td>Role of PD-1 in maintenance of peripheral tolerance and control of EAE (Arlene Sharpe, Harvard Medical School)</td>
</tr>
<tr>
<td>H. Christine Patterson, M.D., Ph.D.</td>
<td>CP 2008-2011</td>
<td>2011-present</td>
<td>Syk in Mitochondrial Stress Signaling and Insulin Resistance (Harvey Lodish, MIT)</td>
</tr>
<tr>
<td>Shakti Ramkissoon, M.D., Ph.D.</td>
<td>AP 2007-2010; Neuropathology 2010-2011</td>
<td>2011-present</td>
<td>Integrative Pathogenomic Analysis of a Primary GBM Cell Line Library Reveals Novel Molecular Subclasses (Keith Ligon, Dana-Farber Cancer Institute)</td>
</tr>
<tr>
<td>Sacha Uljon, M.D., Ph.D.</td>
<td>CP 2006-2009; Transfusion Medicine 2009-2010</td>
<td>2010-present</td>
<td>Structural Studies of Tribbles (Stephen Blacklow, Dana-Farber Cancer Institute)</td>
</tr>
</tbody>
</table>
Clinically-oriented pathology research projects (including clinicopathologic correlations and translational research) in which residents can participate are actively encouraged and widely conducted in our Department. These studies typically utilize case material and involve more sophisticated technologies, such as immunohistochemistry, electron microscopy, molecular cytogenetics, transcriptional profiling, and other molecular biological approaches. The following list provides representative examples of recent and ongoing studies; the Resident is listed, followed by the Faculty mentor in parentheses:

Diagnostic implications of loss of retinoblastoma protein expression in spindle cell/pleomorphic lipomas and cytogenetically related tumors. **Dr. Benjamin Chen**, fellow (Dr. Jason Hornick)

The ability of ovarian cancer cells to attach and “clear” a mesothelial layer: immunohistochemistry against epithelial-mesenchymal transition markers. **Dr. Michael Drage**, resident (Drs. Ronny Drapkin, Joan Brugge and Edmund Cibas)

Computational methods to analyze microbiome time-course data from a defined enteric infection, **Dr. Georg Gerber**, resident (Dr. Lynn Bry)

Oropharyngeal adenocarcinoma: a previously undescribed HPV-associated malignancy. **Dr. John Hanna**, resident (Dr. Jeffrey Krane)

Testing for EGFR and KRAS mutations on cytologic specimens: comparison between primary and metastatic tumors. **Dr. Monica Hollowell**, fellow (Drs. Neal Lindeman, Alarice Lowe and Edmund Cibas)

Atypical endometrial polyps subdiagnostic of mullerian adenosarcoma. **Dr. Brooke Howitt**, resident (Dr. Marisa Nucci)

Dyssynchronous “outlier glands” in secretory endometrium. **Dr. Brooke Howitt**, resident (Dr. George Mutter)

HNF1 and Bap1 expression in renal neoplasia. **Trevor Flood and Brooke Howitt**, fellow and resident (Dr. Michelle Hirsch)

Intestinal type adenocarcinoma of the endocervix. **Dr. Brooke Howitt**, resident (Dr. Marisa Nucci)

Outlier genetically defective clones in "normal" secretory endometrium. **Dr. Brooke Howitt**, resident (Dr. George Mutter)

Stathmin expression in intraepithelial lesions of the cervix. **Dr. Brooke Howitt**, resident (Dr. Michelle Hirsch)

Patterns of invasion in FIGO grade 2 endometrial adenocarcinoma. **Dr. Douglas Lin**, fellow (Dr. Marisa Nucci)
A study of lobular carcinoma in situ of the female breast; variation in histo-morphology and immunohistochemical phenotype and relation to long term outcome. **Dr. Emily Mason**, resident (Dr. Jane Brock)

Endometrial intraepithelial neoplasia with secretory differentiation. **Dr. Carlos Parra-Herran**, fellow (Dr. George Mutter)

Giant condyoma of the cervix. **Dr. Carlos Parra-Herran**, fellow (Dr. Marisa Nucci)

Flow cytometric analysis of malignant epithelial effusions. **Dr. Vinodh Pillai**, resident (Dr. David Dorfman)

Flow cytometric assessment of CD200 (OX-2 membrane glycoprotein) expression in B cell lymphoproliferative disorders. **Dr. Vinodh Pillai**, resident (Dr. David Dorfman)

ER expression in ER positive breast carcinomas using ER-1D5 and ER-SP1 immunohistochemistry. Interobserver variability in scoring using Allred and H score methods. **Dr. Emily Reisenbichler**, fellow (Dr. Jane Brock)

MSI, BRAF mutation and colorectal cancer prognosis. **Dr. Jeanne Shen**, resident (Dr. Shuji Ogino)

**REPRESENTATIVE PUBLICATIONS BY RESIDENTS AND CLINICAL FELLOWS (2005-2012)**


Gable AD, Marsee DK, Milner DA, Granter SR. Suppurative inflammation with microabscess and pseudocyst formation is a characteristic histologic manifestation of cutaneous infections with rapid-growing mycobacterium species. Am J Clin Pathol 2008;130:514-517.


Huang EC, Kuo FC, Fletcher CDM, Nose V. Critical diagnoses in surgical pathology; A retrospective single-institution study to monitor guidelines for communication of urgent results. Am J Surg Path 2009; 33:1098-1102.


Chen EY, Tran A, Raho CJ, Birch CM, Crum CP, Hirsch MS. Histological 'progression' from low (LSIL) to high (HSIL) squamous intraepithelial lesion is an uncommon event and an indication for quality assurance review. Mod Pathol. 2010; 23:1045-51.


Doyle LA, Odze RD. Eosinophilic esophagitis without abundant eosinophils? The expanding spectrum of a disease that is difficult to define. Digestive Dis & Sci 2011; 56:1923-1925.


TEACHING RESPONSIBILITIES AND OPPORTUNITIES

Opportunities for teaching medical and graduate students and pathology and clinical trainees are widely available within the Department, at the Harvard Medical School (HMS) and elsewhere in the local academic community. Members of the Department play important roles as educators in two distinct M.D. curricula at Harvard Medical School, in addition to the biomedical curriculum associated with the Harvard School of Public Health (HSPH):

- **HMS:** There are on average 120 students per class, predominantly M.D.-only students. The curriculum is largely problem-based learning with some elements of didactic and laboratory education.

- **HST:** The Harvard-MIT Division of Health Sciences and Technology (HST) is a distinct M.D. and Ph.D. educational program that synergizes the strengths of the Massachusetts Institute of Technology, Harvard Medical School, Harvard University, and the Harvard teaching hospitals in a unique collaboration that integrates science, medicine, and engineering. There are typically 30-50 students per class, with a mix of M.D., M.D.-Ph.D. and Ph.D.-only students. The curriculum is largely didactic and laboratory-based, with numerous problem sets, and some elements of problem-based learning; there is also a research thesis requirement.

- **HSPH:** There are 20-30 students per class, with greater than 90% holding prior doctoral degrees. The program confers Doctor or Masters of Public Health, Ph.D., or other masters-level degrees. The curriculum is didactic and laboratory.

Trainees usually participate in the capacity of a laboratory instructor or discussion group leader. Since residents hold appointments as Clinical Fellows at HMS, they have an implied responsibility to participate in the teaching programs.

Offerings in which members of the department are particularly central (as Directors or Section Leaders) include:

**HMS Courses:**

- **Immunology, Microbiology and Pathology (Drs. Lichtman, Padera and Sharpe, Course Co-Directors):** a 12-week required pre-clinical course in the first year that teaches the fundamentals of systemic pathology, as well as microbial pathogenesis and the responses of the host immune system.

- **Clinical Tropical Medicine (Dr. Milner, Course Co-Director):** a one-month clinical elective offered twice annually.

**HST Courses:**

- **Human Pathology (Drs. Mitchell and Padera, Course Co-Directors):** a 13-week required pre-clinical course in the first year that teaches normal structure-function, the fundamentals of systemic pathology, and the current practice of academic pathology, in addition to a thorough leavening with state-of-the art biomedical research.

- **Molecular Biology and Human Genetics (Dr. Giersch, Course Co-Director):** a 12-week required pre-clinical course in the first year that teaches fundamentals of molecular biology, and human genetic disease.
Human Biochemistry and Metabolic Diseases (Dr. Mitchell, Course Director): a 4-week required pre-clinical course in the first year that teaches fundamentals of human intermediary metabolism.

Cardiovascular Pathophysiology (Dr. Schoen, Pathology Coordinator): a 12-week required pre-clinical course in the first year that teaches fundamentals of cardiovascular physiology and disease.

Renal Pathophysiology (Dr. Rennke, Pathology Coordinator): a 12-week required pre-clinical course in the first year that teaches fundamentals of renal physiology and disease.

Respiratory Pathophysiology (Dr. Kobzik, Pathology Coordinator): a 12-week required pre-clinical course in the first year that teaches fundamentals of pulmonary physiology and disease.

Biomaterials, Tissue Engineering, and Regenerative Therapeutics (Dr. Schoen, Course Director): a 13-week pre-clinical or advanced elective.

Blood Vessels and Endothelial Phenotypes in Health and Disease (Dr. Garcia-Cardena, Course Co-Director): a 13-week pre-clinical elective.

HSPH Course:

Pathophysiology of Human Disease (Dr. Kobzik, Course Director): a 12-week course required for most students that teaches the fundamentals of systemic pathology.

The HMS Immunology, Microbiology and Pathology course and the HST Human Pathology course are the primary introductions to disease mechanisms and pathophysiology for all first year students at Harvard Medical School. These courses are highly rated, and in fact, receive among the best overall course evaluations among the pre-clinical offerings in either curricula. In addition, Drs. Lichtman, Milner, Mitchell, Padera, and Schoen have all been recognized by school-wide teaching awards voted upon by the HMS and/or HST students. Residents also serve as day-to-day preceptors to 3rd and 4th year medical students doing the one-month elective pathology clinical clerkships in our department. The Chief Resident is especially active in helping each student prepare an oral presentation to the department that is given at the end of their rotation (Gross Micro Conference).

Residents teach their peers in the pathology training program which includes: serving as designated formal trainers in surgical pathology early in the academic year; Chief Residents acting as tutors in autopsy pathology for beginning residents and as on-call supervisors; residents teaching residents on a day-to-day basis by presenting cases at the Interesting Case Slide Conferences, the Autopsy Gross Conferences, and through giving Gross Micro Conference presentation. Residents teach their peers in other departments in the hospital through presentations at many interdepartmental conferences, including Medical Pathology Conference, Surgical M & M Conference, and Radiology/Pathology Correlations Conference.

Some advanced residents and fellows participate in and help run CME courses conducted by subspecialty faculty.
DEPARTMENT OF PATHOLOGY FACULTY

Jeffrey A. Golden, MD  Chairman
Frederick Schoen, MD/PhD  Executive Vice-Chairman; Cardiac and Autopsy Pathology

Agoston Agoston, MD/PhD  Surgical Pathology; Gastrointestinal Pathology
Jon Aster, MD/PhD  Chief, Hematopathology; Molecular Oncology Research
Justine A. Barletta, MD  Surgical Pathology; Endocrine and Genitourinary Pathology
Frederick Bieber, PhD  Embryology and Genetics
Vanesa Bijol, MD  Renal Pathology
Steven Blacklow, MD/PhD  Structural Biology Research
Manfred Brigl, MD  Microbiology
Jane E. Brock, MBBS/PhD  Surgical Pathology; Breast Pathology
Gilbert Brodsky, MD  Surgical Pathology
Lynn Bry, MD/PhD  Clinical Microbiology; Pathology Information Technology; Gastrointestinal Inflammation Research
Ruben Carrasco, MD/PhD  Hematopathology
Li Chai, MD  Assistant Medical Director, BWH Blood Bank; Molecular Hematology Research
Lucian Chirieac, MD  Surgical Pathology; Pulmonary Pathology
Edmund Cibas, MD  Director, Cytopathology Division
Joseph Corson, MD  Surgical Pathology; Oncologic Pathology; Rheumatic Disease
Christopher Crum, MD  Director, Women's and Perinatal Division
Paola Dal Cin, PhD  Cytogenetics
Umberto De Girolami, MD  Neuropathology
Deborah Dillon, MD  Breast Pathology; Breast Biomarkers Research
Daniela Dinulescu, PhD  Tumor Biology Research
David Dorfman, MD/PhD  Associate Director, Clinical Laboratories; Medical Director, Hematology Laboratory; Hematopathology
Leona Doyle, MD  Surgical Pathology; Gastrointestinal Pathology
Ronald Drapkin, MD/PhD  Tumor Biology Research
Mel Feany, MD/PhD  Neuropathology; Neuropathology Research
Christopher Fletcher, MD  Director, Surgical Pathology Division; Oncologic and Soft Tissue Pathology
Jonathan Fletcher, MD  Director, Solid Tumor Cytogenetics; Molecular Cytogenetics Research
Rebecca Folkerth, MD  Director, Neuropathology Division
Christopher French, MD  Cytopathology; Molecular Cytogenetics Research
Eleonora Galvanek, MD  Cytopathology
Guillermo Garcia-Cardenas, PhD  Vascular Biology Research
Anne Giersch, PhD  Cytogenetics; Cytogenetics of Hearing Research
John Godleski, MD  Chief, Pulmonary Pathology; Inhaled Particle Disease Research
Scott Granter, MD  Dermatopathology
Michael Gimbrone, Jr., MD  Director, Vascular Research Division
Michelle Hirsch, MD/PhD  Chief, Genitourinary Pathology; Women’s and Perinatal Pathology; Surgical Pathology
Jason Hornick, MD/PhD  Gastrointestinal Pathology; Hematopathology; Surgical Pathology
Petr Jarolim, MD/PhD  Medical Director, Chemistry Laboratory
Vickie Jo, MD   Surgical Pathology; Cytopathology
Richard Kaufman, MD   Medical Director, BWH Blood Bank/Transfusion Medicine
Michael Kluk, MD/PhD  Molecular Diagnostics
Lester Kobzik, MD   Pulmonary Pathology; Pulmonary Pathobiology Research
Jeffrey Krane, MD/PhD  Chief, Head and Neck Pathology; Surgical Pathology; Cytopathology
Frank Kuo, MD/PhD  Director, Pathology Information Technology Division; Hematopathology; Molecular Diagnostics
Alvaro Laga Canales, MD  Dermatopathology
Charles Lee, PhD   Cytogenetics; Molecular Cytogenetics Research
Kenneth Lee, MD   Women’s and Perinatal Pathology
Susan Lester, MD/PhD  Chief, Breast Pathology; Surgical Pathology
Andrew Lichtman, MD/PhD  Autopsy Pathology; Molecular and Cellular Immunology Research
Hart Lidov, MD/PhD  Neuropathology
Azra Ligon, PhD   Cytogenetics
Keith Ligon, MD/PhD  Neuropathology; Neurooncopathology Research
Neal Lindeman, MD  Chief, Molecular Diagnostics; Associate Residency Program Director
Massimo Loda, MD  Genitourinary Pathology; Molecular Oncology Research; Director, BWH/DFCI Center for Molecular Oncologic Pathology
Alarice Lowe, MD  Surgical Pathology; Cytopathology
C. John Luckey, MD/PhD  Transfusion Medicine; Stem Cell Biology Research
William Luscinskas, PhD  Vascular Research
Tanya Mayadas-Norton, PhD  Vascular Research
Stacy Melanson, MD/PhD  Associate Medical Director, Chemistry Laboratory; Diagnostic Proteomics Research
Danny Milner, MD   Infectious Disease; Microbiology; Autopsy Pathology; Malaria Pathobiology Research
David Milstone, MD/PhD  Vascular Research
Richard Mitchell, MD/PhD  Cardiac Pathology; Autopsy Pathology; Cellular and Molecular Immunology Research
Elizabeth Morgan, MD  Hematopathology
Cynthia Morton, PhD  Director, Cytogenetics Division; Molecular Cytogenetics Research; Co-Director, Advanced Molecular Diagnostics Laboratory
George Murphy, MD   Chief, Dermatopathology; Dermatopathology Research
George Mutter, MD  Women’s and Perinatal Pathology; Women’s Neoplasia Research
Marisa Nucci, MD  Women’s and Perinatal Pathology
Robert Odze, MD, FRCP • Chief, Gastrointestinal Pathology; Surgical Pathology
Shuji Ogino, MD/PhD • Molecular Diagnostics; Molecular Oncology Pathology Research
Andrew Onderdonk, PhD • Medical Director, Microbiology Laboratory
Robert Padera, MD, PhD • Cardiac Pathology; Pulmonary Pathology; Autopsy Pathology
Geraldine Pinkus, MD • Hematopathology
Olga Pozdnyakova, MD • Hematopathology
Xiaohua Qian, MD/PhD • Cytopathology; Surgical Pathology
Bradley Quade, MD/PhD • Women's and Perinatal Pathology; Women's Neoplasia Research
Heidi Rehm, PhD • Molecular Cytogenetics; Molecular Cytogenetics Research
Helmut Rennke, MD • Chief, Renal Pathology
Andrea Richardson, MD • Breast Pathology
Scott Rodig, MD/PhD • Hematopathology; Hematopathology Research
Sandro Santagata, MD/PhD • Neuropathology; Neuropathology Research
William Savage, MD • Transfusion Medicine
Arlene Sharpe, MD/PhD • Director, Immunology Research Division; Developmental Virology, Molecular Biology; Director, BWH Transgenic Facility
Lynette Sholl, MD • Surgical Pathology; Thoracic Pathology; Molecular Diagnostic Pathology
Sabina Signoretti, MD • Translational Molecular Pathology Research
Leslie Silberstein, MD • Director, Joint Program in Transfusion Medicine
Amitabh Srivastava, MD • Surgical Pathology
Milenko Tanasijevic, M.D. • Director, Clinical Laboratories Division
Sara Vargas, MD • Pulmonary Pathology; Pediatric Pathology (Children's Hospital)
William Welch, MD • Women's and Perinatal Pathology; Genitourinary Pathology; Surgical Pathology
Stanislawa Weremowicz, PhD • Cytogenetics
Tad Wieczorek, MD • Cytopathology; Surgical Pathology (Faulkner Hospital)
Gayle Winters, MD • Director, Pathology Residency Program; Director, Autopsy Division; Director, Cardiac Pathology
Sheng Xiao, MD • Cytogenetics; Research
# 2012-2013 Residents and Clinical Fellows

<table>
<thead>
<tr>
<th>Year</th>
<th>Degree(s)</th>
<th>Medical School</th>
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<tbody>
<tr>
<td><strong>1st year Residents</strong></td>
<td></td>
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</tr>
<tr>
<td>Tejus Bale</td>
<td>MD/PhD</td>
<td>Stony Brook University Medical Center</td>
</tr>
<tr>
<td>Roger Belizaire</td>
<td>MD/PhD</td>
<td>Washington University / St Louis Sch of Medicine</td>
</tr>
<tr>
<td>Leigh Compton</td>
<td>MD/PhD</td>
<td>Vanderbilt University School of Medicine</td>
</tr>
<tr>
<td>Donelle Cummings</td>
<td>MD</td>
<td>Case Western Reserve Univ Sch of Medicine</td>
</tr>
<tr>
<td>Jacqueline Golden</td>
<td>MD</td>
<td>University of Miami/Leonard Miller Sch of Medicine</td>
</tr>
<tr>
<td>Matthew Greenblatt</td>
<td>MD/PhD</td>
<td>Harvard Medical School</td>
</tr>
<tr>
<td>David Meredith</td>
<td>MD/PhD</td>
<td>University of Texas Southwestern Medical Center</td>
</tr>
<tr>
<td>Vera Paulson</td>
<td>MD/PhD</td>
<td>University of Texas Southwestern Medical Center</td>
</tr>
<tr>
<td>Annely Richardson</td>
<td>MD</td>
<td>Boston University School of Medicine</td>
</tr>
<tr>
<td>Elizabeth Rinehart</td>
<td>MD</td>
<td>University of Kansas School of Medicine</td>
</tr>
<tr>
<td>Thing “Rinda” Soong</td>
<td>MD/PhD</td>
<td>Johns Hopkins University School of Medicine</td>
</tr>
<tr>
<td><strong>2nd year Residents</strong></td>
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<tr>
<td>Margaret Choy</td>
<td>MD/PhD</td>
<td>New York University</td>
</tr>
<tr>
<td>James Conner</td>
<td>MD/PhD</td>
<td>Tufts University</td>
</tr>
<tr>
<td>Michael Drage</td>
<td>MD/PhD</td>
<td>Case Western Reserve University</td>
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<tr>
<td>Ruth Foreman</td>
<td>MD/PhD</td>
<td>Harvard Medical School</td>
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<tr>
<td>David Hwang</td>
<td>MD</td>
<td>University of Chicago/Pritzker</td>
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<tr>
<td>Diana Mandelker</td>
<td>MD/PhD</td>
<td>Johns Hopkins University</td>
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<tr>
<td>Melanie Johncilla</td>
<td>MD</td>
<td>Yale University</td>
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<tr>
<td>Emily Mason</td>
<td>MD/PhD</td>
<td>Duke University</td>
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<tr>
<td>Jelena Mirkovic</td>
<td>MD/PhD</td>
<td>Tufts University</td>
</tr>
<tr>
<td>Nicole Pecora</td>
<td>MD/PhD</td>
<td>Case Western Reserve University</td>
</tr>
<tr>
<td>Eric Yang</td>
<td>MD/PhD</td>
<td>Tufts University</td>
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<td><strong>3rd year Residents</strong></td>
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<tr>
<td>Benjamin Chen</td>
<td>MD/PhD</td>
<td>Northwestern University</td>
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<tr>
<td>James Kelley</td>
<td>MD/PhD</td>
<td>University of Alabama</td>
</tr>
<tr>
<td>Emily King</td>
<td>MD</td>
<td>Oregon Health &amp; Science University</td>
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<tr>
<td>Brooke Lane</td>
<td>MD</td>
<td>Stanford University</td>
</tr>
<tr>
<td>Douglas Lin</td>
<td>MD/PhD</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>Zoltan Nagymanyoki</td>
<td>MD/PhD</td>
<td>Semmelweis University, Hungary</td>
</tr>
<tr>
<td>Jonathan Nowak</td>
<td>MD/PhD</td>
<td>Weill Medical College/Cornell University</td>
</tr>
<tr>
<td>Jeanne Shen</td>
<td>MD</td>
<td>Washington University</td>
</tr>
<tr>
<td>Matthew Stachler</td>
<td>MD/PhD</td>
<td>Ohio State University</td>
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<tr>
<td>Marina Vivero</td>
<td>MD/PhD</td>
<td>University of Michigan</td>
</tr>
<tr>
<td><strong>4th year Residents</strong></td>
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<tr>
<td>Vinodh Pillai</td>
<td>MD/PhD</td>
<td>Chennai Medical College, India</td>
</tr>
<tr>
<td>Andrew Quinn</td>
<td>MD</td>
<td>State University of New York, Syracuse</td>
</tr>
<tr>
<td>Kyle Viani</td>
<td>MD</td>
<td>University of Michigan</td>
</tr>
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* denotes Straight CP resident; all others are AP only or AP/CP
<table>
<thead>
<tr>
<th>Clinical Fellows</th>
<th>Degree(s)</th>
<th>Medical School</th>
<th>Rotations/Fellowships</th>
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<tbody>
<tr>
<td>Cheryl Adackapara</td>
<td>MD</td>
<td>Johns Hopkins University</td>
<td>Surgical Pathology</td>
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<tr>
<td>Ibrahim Batal</td>
<td>MD</td>
<td>University of Damascus, Syria</td>
<td>Renal Pathology</td>
</tr>
<tr>
<td>Valerie Brostrom</td>
<td>MD</td>
<td>University of Chicago/Pritzker Sch of Med</td>
<td>Breast Pathology</td>
</tr>
<tr>
<td>Alanna Church</td>
<td>MD</td>
<td>Queen's University, Ontario, Canada</td>
<td>Molecular Genetic Pathology</td>
</tr>
<tr>
<td>Pedro Ciarlini</td>
<td>MD</td>
<td>Federal University of Ceara, Brazil</td>
<td>Neuropathology</td>
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<tr>
<td>Stacey Eggert</td>
<td>PhD</td>
<td>Harvard University</td>
<td>Cytogenetics</td>
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<tr>
<td>Christopher Elco</td>
<td>MD/PhD</td>
<td>Case Western Reserve</td>
<td>Dermatopathology</td>
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<tr>
<td>Andrew Evans</td>
<td>MD/PhD</td>
<td>Emory University</td>
<td>Hematopathology</td>
</tr>
<tr>
<td>Wen-Chi Foo</td>
<td>MD</td>
<td>Duke University</td>
<td>Cytopathology</td>
</tr>
<tr>
<td>Kevin Golden</td>
<td>MD/PhD</td>
<td>University of Miami</td>
<td>Gastrointestinal Pathology</td>
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<tr>
<td>John Hanna</td>
<td>MD/PhD</td>
<td>Harvard Medical School</td>
<td>Dermatopathology</td>
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<tr>
<td>Siddhartha Jaiswal</td>
<td>MD/PhD</td>
<td>Stanford University</td>
<td>Transfusion Medicine</td>
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<tr>
<td>Cynthia Jimenez</td>
<td>MD</td>
<td>University California San Francisco</td>
<td>Women's and Perinatal Pathology</td>
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<tr>
<td>Yeowon Kim</td>
<td>MD</td>
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<td>William Lane</td>
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<td>Winston Lee</td>
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<td>Madelyn Lew</td>
<td>MD</td>
<td>State University of New York</td>
<td>Cytopathology</td>
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<tr>
<td>Paul Masry</td>
<td>MD</td>
<td>Queen's University, Ontario, Canada</td>
<td>Genitourinary Pathology</td>
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<tr>
<td>Valentina Nardi</td>
<td>MD</td>
<td>University of Genoa, Italy</td>
<td>Molecular Genetic Pathology</td>
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<tr>
<td>Jeremy “Ryan” Pena</td>
<td>MD/PhD</td>
<td>Baylor College of Medicine</td>
<td>Transfusion Medicine</td>
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<tr>
<td>Saraswati Pokharel</td>
<td>MD/PhD</td>
<td>Tribhuvan University, Kathmandu, Nepal</td>
<td>Thoracic Pathology</td>
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<tr>
<td>Emily Reisenbichler</td>
<td>MD</td>
<td>University of Texas - Galveston</td>
<td>Surgical Pathology</td>
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<td>Matthew Rose</td>
<td>MD/PhD</td>
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<td>Neuropathology</td>
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<td>Michael Seidman</td>
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<td>Molecular Genetic Pathology</td>
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<td>Namrata Setia</td>
<td>MD</td>
<td>Maulana Azad Medical College, India</td>
<td>Surgical Pathology</td>
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<td>Eric Severson</td>
<td>MD/PhD</td>
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<td>Shu-Hsien Sheu</td>
<td>MD/PhD</td>
<td>National Taiwan University</td>
<td>Neuropathology</td>
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<tr>
<td>Kremena Star</td>
<td>MD/PhD</td>
<td>Albert Einstein College of Medicine</td>
<td>Gastrointestinal Pathology</td>
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</table>
RESIDENT RECRUITMENT AND SELECTION

Recruitment Process

Residency candidates apply through ERAS (Electronic Residency Application Service) and are selected through the NRMP. Over the last five years, the Department has seen an increase in the number of applicants from approximately 300 per year to approximately 500. A third of the applicants are from U.S. medical schools and two-thirds from international or osteopathy programs; male and female numbers are approximately equal. Of the 500 applicants in the last two years, roughly 75-80 were interviewed (~15%), with the majority coming from U.S. programs. Approximately 9-10 AP (or combined AP/CP) resident slots and 2 CP resident positions are selected per year. Residents need not hold U.S. citizenship.

Institutional, NRMP and PRODS ethical and other guidelines pertaining to recruitment policies and procedures are scrupulously followed.

Recruitment and selection of residents is conducted by the Departmental Residency Recruitment and Selection Committee. Meeting weekly between November and February, the Committee is chaired by the Program Director, and comprises the Departmental Chair, Executive Vice-Chair, major clinical division directors and selected other senior AP and CP faculty, several laboratory investigators, and 2 senior residents—typically the Chief Residents. These individuals also actively interview residency candidates during their 1-2 day visits. Evaluation is based on medical school record, letters of recommendation, standardized test scores, aptitude, academic credentials, personal characteristics, communication skills, and the ability to benefit from the opportunities offered by our training program. Over the past 3 years there has been a significant and discernable spike in the applicant pool; the impression is that greater numbers of academically-oriented medical school graduates are increasingly appreciating the enriched opportunities in Pathology for balancing clinical and research careers. Recognizing that diversity of thought and perspective provides richer solutions to the complex challenges of research and academic medicine, the BWH Pathology Department seeks to recruit trainees who reflect the character of the American society, and to also foster a training environment that values and rewards diversity. Along those lines, Department Faculty have a long track-record in “pipeline” solutions to encourage minority involvement in medicine and research, including regular participation in the NHLBI-supported (R25) Summer Honors Undergraduate Research Program (SHURP) administered by the HMS Division of Medical Sciences for college students from under-represented groups. Nevertheless, the Department is largely dependent upon national educational systems to provide the M.D. or M.D.-Ph.D. level training for our Residency candidates. On average, the potential pool of applicants in Pathology contains 4% of individuals who self-identified as under-represented minorities (URM).

Every qualified URM interviewee for the BWH Training Program meets with Dr. Winters, the Training Program Director and either Dr. Golden, Chairman or Dr. Schoen, Vice Chairman. Likewise, every candidate expressing a particular interest in research opportunities also meets individually with Dr. Mitchell, Director of Research Career Development, as well as clinical, and/or research faculty within her/his field of interest. The BWH Office for Multicultural Careers (OMC) also reaches out to minority interviewees at BWH, distributes information on the services OMC provides, and invites interviewees to join in hospital-wide receptions hosted several times throughout the official residency interview season. In partnership with the OMC, As a result of these proactive measures, over the last
decade, there has been an incremental upturn in minority recruitment, with the Department matching nine minority Resident trainees (or roughly 7% of the total number of Residents) over that period.

OUTCOMES

Over the last decade of the program, 72 AP Residents, 69 AP/CP Residents, and 27 CP-Only Residents have graduated the training program. Despite concerns over research funding support and the overall perceptions regarding job security in academic medicine, the BWH Pathology Training Program not seen any trend to increasing numbers ofTrainee graduates pursuing AP/CP training, or strictly clinical or community-based pathology positions. Moreover, as successive years of trainees are assessed, it is clear that residents in the BWH program continue to follow a largely academic training model progressing from Residency through Fellowships (research and clinical), and into Instructor and Junior Faculty positions. Within 10 years of matriculating into the program, the major population of graduates (roughly two-thirds) occupies Faculty positions (Assistant Professorships) within academic institutions; a smaller fraction holds senior positions in community-based practices (roughly 25%) or has embarked on careers in industry (5-10%).
USMLE COMPLETION FOR CLINICAL TRAINEES

Applicability: Residents and Clinical Fellows beginning training on or after June 1, 2010.

- Documentation of successful completion of USMLE Step II must be submitted for initial appointment as a Resident or Clinical Fellow (or for reappointment, if not previously provided).

- Documentation of successful completion of USMLE Step III is required for appointment (or reappointment) at the PGY 3 level or higher.

- Documentation of successful completion of USMLE Step III is required for graduation from all Partners residency and fellowship programs.

- Program Directors/Chiefs, in consultation with the Director or Associate Director of GME, may grant individual exceptions to the above provisions for one year at a time.

- Canadian physicians and Doctors of Osteopathy who are eligible for licensure may substitute documentation of successful completion of LMCC/MCCQE and COMLEX examinations, respectively, in lieu of USMLE examinations.

MENTORING

Mentoring occurs extensively during day-to-day contact between residents and faculty. In addition, a structured mentoring program matches incoming residents with a faculty mentor to provide information and support during the core rotations. Mentors initiate periodic (at least 2) informal meetings throughout the year. Program and career mentoring is also included in the twice annual evaluation and career planning meetings with the Residency Program Director. As residents develop subspecialty interests during the course of their residency training, they seek out and/or are directed to specific faculty who have similar interests and would serve as suitable role models.
SUPERVISION

Residents assigned to pathology cases or specimens work under the supervision of staff attending physicians who are independently licensed and duly credentialed by the hospital. The resident’s name appears on the pathology report as “resident” or “prosector” and the report is signed by the attending physician.

Residents on beeper call are covered by one or more attending pathologists who are available by beeper/phone to provide telephone or on-site consultation. If the attending of record is not available in a timely manner, the resident contacts the respective (Anatomic Pathology or Clinical Pathology) Chief Resident on their designate who carries a beeper at all times and can assist the resident in reaching alternative attending staff and/or Division Directors.

Residents who cannot complete his/her assigned duties due to illness or other emergency contact the respective (Anatomic Pathology or Clinical Pathology) Chief Resident who arranges emergency coverage. For complex situations or anticipated prolonged absences, the resident should contact the Program Director. If the resident encounters a heavier clinical load than he/she feels able to manage or encounters any problems with their supervising attending physician(s), the resident should contact the Program Director or the Executive Vice Chairman.

Supervision of PGY1 Residents:

Definitions:

**Direct Supervision**: supervising physician is physically present with the resident.

**Indirect Supervision with Direct Supervision Immediately Available**: supervising physician is physically within the hospital and is immediately available.

**Indirect Supervision with Direct Supervision Available**: supervising physician is not physically within the hospital but is immediately available by telephone and/or other electronic modalities.

**Oversight**: supervising physician is available to provide review of procedures with feedback after care is delivered.

Each PGY 1 resident must be **directly supervised** during performance of, at least, his or her **three** initial procedures in the following areas:

- Autopsies
- Gross dissection of surgical pathology specimens by organ system
- Frozen sections
- Apheresis
- Fine needle aspirations/interpretation of the aspirate

A senior resident, pathology assistant, or attending pathologist may directly supervise the gross dissection/frozen sections of surgical specimens or autopsies.
A senior resident, bloodbank/transfusion medicine fellow, or attending pathologist may directly supervise apheresis.

Residents must document the performance of their first three of the listed procedures (above) and completed forms turned in to the Program Director's Office.

**EVALUATION OF RESIDENT PERFORMANCE**

The performance of residents is evaluated by objective and subjective criteria which include day to day performance, knowledge base, diagnostic acumen, responsibility, judgment, cooperation, interest and motivation, leadership ability, communication skills, teaching ability, and overall academic potential. In addition, on some rotations, the ability to diagnose unknown slides/cases is examined.

Electronic evaluations are completed by the supervising faculty on a weekly (for first and second year residents) or quarterly (for third and fourth year residents) basis and are available to residents through New Innovations. Twice yearly, summary evaluations are printed, a copy is given to the resident during semi-annual Evaluation/Career Planning Meetings, and a copy is kept in the resident's permanent departmental file. The entire faculty meets twice yearly for a confidential group discussion of each resident. In addition, faculty are encouraged to provide continuous feedback to residents on a day to day basis. 360° evaluations are solicited from Pathology Assistants, technicians, and clerical staff.

Every 6 months, and more frequently as necessary, each resident meets individually with the Residency Program Director for a confidential evaluation feedback and career planning meeting.

The American Society of Clinical Pathology (ASCP) Residents’ In-Service Examination is offered to residents each year. Grading and analysis of results is provided to each resident as a self-assessment tool.

The Program Director is informed of resident progress through written evaluations by Division Directors, twice yearly faculty meetings held to discuss each resident's progress, and personal observation. All residents who are performing satisfactorily are automatically promoted to the next year in the program. All proceedings, discussions, and meetings are strictly confidential.

Any resident whose progress is deemed marginal or unsatisfactory is monitored more closely during subsequent rotations and individualized remediation is formulated by a committee that includes the Chairman, Executive Vice Chairman, and the Residency Program Director, and initiated as appropriate.

The Partner’s Director of Graduate Medical Education and legal counsel are consulted during consideration of adverse actions. Adverse action, including probation and dismissal, is undertaken in accordance with the Brigham Graduate Medical Education Office policy on “Graduate Trainee Adverse Action Process.”
EVALUATION OF FACULTY BY RESIDENTS

Residents evaluate faculty quarterly based on matching of resident and faculty schedules through New Innovations. To preserve anonymity of faculty member reviews by residents (as required), individual faculty members’ composite/collated reviews by the residents will, with rare exceptions, be distributed to the faculty member annually, without edit, and will be incorporated into individual faculty member’s annual review by the Chair or Division or Service Chief.

EVALUATION OF THE PROGRAM BY THE RESIDENTS

The educational effectiveness of the residency program and ability to meet educational goals are continually assessed on a day-to-day basis by Drs. Schoen, Winters, and other faculty members as well as by periodic formal processes on several levels. Meetings with the entire resident group are held quarterly to discuss ongoing issues and developments and provide feedback to the residents on changes contemplated or implemented. Chief and senior residents play an important role in this dialogue. In addition, the Departmental Education Committee, composed of the key personnel involved in residency training and other educational programs, meets 2-3 times per year to review and monitor various ongoing and arising training matters including curriculum, recruitment and selection, contemplated program changes, individual resident needs and external influences.

Residents provide formal evaluation of the program yearly by anonymously completing a form provided by and returned to the program via an electronic survey. Residents are asked to evaluate many areas of the program from quality of material, teaching, conferences, facilities, teaching resources, rotations, and affiliations to our fairness in scheduling and mentoring. Feedback from program evaluations identifies problem areas and is an important stimulus to program enhancements.

CERTIFICATE OF COMPLETION

A certificate is issued upon completion of residency training, that is, when the resident satisfactorily completes requirements to sit for Boards in AP, CP, or AP/CP.

If the resident intends to continue with fellowship training in the department, the certificate may be delayed until fellowship training is completed and a combined certificate is then issued. NOTE: Residents in combined primary and subspecialty programs (Neuropathology) will receive a certificate upon successful completion of their primary and subspecialty training.

A resident leaving the program prior to completion will receive a certificate for that portion of the program completed (i.e. 1 year of residency in AP).

Certificates for fellowship training may be issued separately for the fellowship period only (usually fellows from other residency programs) or may be combined with residency training (usually fellows who also did their residency at BWH).
DEPARTMENTAL TRAINEE AWARDS

Pier F. Paci Memorial Award for excellence in teaching is awarded annually by the pathology residents to honor a faculty member who has contributed substantially to their pathology education.

The Felix M. Brown, M.D. Pathologist-in-Training Award is given to a resident or clinical fellow in Pathology whose humanity, generosity, and dedication complement their exceptional talents as a physician. The selection committee is composed of a broad cross-section of departmental personnel, including physicians and support staff.

Stanley L. Robbins Memorial Research Award is made annually to a resident, fellow or junior faculty member in the Department of Pathology at the Brigham and Women’s Hospital (not having other research grants) for a project related broadly to the field of pathology.

Thomas J. Gill, III, M.D. and Simon J. Simonian, M.D., ScD Prize for Research Excellence is given to a clinical or research trainee in recognition of outstanding achievement in clinical, translational or basic science research, as evidenced by an outstanding poster presented at the Annual Departmental Research Celebration.

VACATION

Residents and clinical fellows receive four weeks of vacation per year.
RESIDENT EDUCATIONAL ALLOWANCE

The Department of Pathology strongly endorses educational/professional development of its residents and fellows. Financial support for such activities will be made available as follows:

General:

- Each Resident entering year 1 of the AP or CP core will have a total of $2,000 available to spend during their entire training period.
- Each Resident/Clinical Fellow entering the Program following year 1 or not completing training will have available $500 per full academic year in the program.
- Unspent amounts may be accrued from year to year, but may not be transferred or removed as cash upon leaving the Program.
- Allowable expenses/reimbursements include travel to an approved medical/scientific meeting/course of choice, books, journal subscriptions, computer-related purchases, and/or other educational expenses.
- This allowance will supplement any existing special stipends (e.g., Residents/Clinical Fellows presenting at a meeting and Chief Residents’ additional meeting allowance; see below).

For travel to scientific meetings/courses:

- Attendance at scientific meetings is encouraged. Leave of absence for attendance will be granted subject to the written approval of the Chief Resident.

- Residents/Fellows who have papers accepted for presentation (platform or poster) at scientific meetings may have reasonable travel expenses reimbursed up to $2,000 in a given academic year. Sharing of hotel rooms, economy airfares, and other measures to stretch travel dollars are encouraged.

- Residents who have served as Chief Resident (AP or CP) or Senior Resident on Surgical Pathology (SRSP), have an additional meeting allowance up to $2,000, whether or not they present a paper.

For reimbursement, residents must setup an account on the Expenses website, make Donna Martin (DFM0) a delegate on the account, complete an expense report, attach original receipts to the expense report, and, if the resident presented, attach a copy of the letter or form which indicates the abstract was accepted for presentation. Submit the completed expense report, etc to Margarita Rosado, Residency Recruitment Office, Amory Lab Bldg, 3rd floor, rm 360H.
## ALUMNI OF THE PATHOLOGY RESIDENCY TRAINING PROGRAM
### 2000-2012

<table>
<thead>
<tr>
<th>Name</th>
<th>Start date</th>
<th>Type training</th>
<th>Current Position</th>
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<tbody>
<tr>
<td>Derek Abbott</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor, Case Western Reserve University</td>
</tr>
<tr>
<td>Marc Barry</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor, University of New Mexico</td>
</tr>
<tr>
<td>Brian Chang</td>
<td>2000</td>
<td>AP/CP</td>
<td>Pathologist, Delnor Community Hospital, Geneva, IL</td>
</tr>
<tr>
<td>Roger Greenberg</td>
<td>2000</td>
<td>CP</td>
<td>Assistant Professor, University of Pennsylvania School of Med</td>
</tr>
<tr>
<td>Joel Henderson</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor, Boston University School of Medicine</td>
</tr>
<tr>
<td>Anthony John Iafrate</td>
<td>2000</td>
<td>AP</td>
<td>Associate Professor, Massachusetts General Hospital</td>
</tr>
<tr>
<td>Christopher Ianelli</td>
<td>2000</td>
<td>CP</td>
<td>CEO, iSpecimen Inc, Newton, MA</td>
</tr>
<tr>
<td>Paul Jedlicka</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor, University of Colorado, Denver</td>
</tr>
<tr>
<td>Alexander Lazar</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor, MD Anderson Cancer Center</td>
</tr>
<tr>
<td>Lesley Lomo</td>
<td>2000</td>
<td>AP/CP</td>
<td>Assistant Professor, University of New Mexico</td>
</tr>
<tr>
<td>Danny Milner</td>
<td>2000</td>
<td>AP/CP</td>
<td>Assistant Professor HMS, BWH Pathology</td>
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<td>Robert Padera</td>
<td>2000</td>
<td>AP</td>
<td>Assistant Professor HMS, BWH Pathology</td>
</tr>
<tr>
<td>Gregory Wolgamot</td>
<td>2000</td>
<td>AP</td>
<td>Pathologist, Northwest Pathology, Bellingham, WA</td>
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<tr>
<td>Tao Yang</td>
<td>2000</td>
<td>AP/CP</td>
<td>Pathologist, Caritas Good Samaritan Med Center, Brockton</td>
</tr>
<tr>
<td>Gerald Bailey</td>
<td>2001</td>
<td>AP</td>
<td>Gastrointestinal Pathologist, AmeriPath Northeast, Sheldon, CT</td>
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<tr>
<td>Robert Blelloch</td>
<td>2001</td>
<td>CP</td>
<td>Associate Professor, University of California, San Francisco</td>
</tr>
<tr>
<td>Elizabeth Bundock</td>
<td>2001</td>
<td>AP</td>
<td>Deputy Chief Medical Examiner, OCME of Vermont</td>
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<tr>
<td>Frank David</td>
<td>2001</td>
<td>AP</td>
<td>Consultant, Leerink Swann Strategic Advisors, Boston</td>
</tr>
<tr>
<td>Xuefei Hong</td>
<td>2001</td>
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<td>Pathologist, Faulkner Hospital, Boston</td>
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<tr>
<td>Jonathan Lin</td>
<td>2001</td>
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<tr>
<td>David Lombard</td>
<td>2001</td>
<td>AP</td>
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<tr>
<td>Chance John Luckey</td>
<td>2001</td>
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<tr>
<td>Kirstine Oh</td>
<td>2001</td>
<td>AP/CP</td>
<td>Pathologist, Cellnetix Pathology Laboratory, Seattle, WA</td>
</tr>
<tr>
<td>Miguel Rivera</td>
<td>2001</td>
<td>AP</td>
<td>Assistant Professor, HMS, Massachusetts General Hospital, Boston</td>
</tr>
<tr>
<td>Peter Van den Elzen</td>
<td>2001</td>
<td>CP</td>
<td>Assistant Professor, University of British Columbia</td>
</tr>
<tr>
<td>Name</td>
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<tr>
<td>Aleksandar Babic</td>
<td>2002</td>
<td>CP</td>
<td>Adjunct Instructor, Baylor Center for Cell and Gene Therapy</td>
</tr>
<tr>
<td>Michael Bennett</td>
<td>2002</td>
<td>AP</td>
<td>Pathologist, Mercy University Hospital</td>
</tr>
<tr>
<td>Julia Elvin</td>
<td>2002</td>
<td>AP</td>
<td>Converge Diagnostics, Peabody, MA</td>
</tr>
<tr>
<td>Ron Firestein</td>
<td>2002</td>
<td>AP</td>
<td>Genentech, Inc, San Francisco, CA</td>
</tr>
<tr>
<td>Ellen Foxman</td>
<td>2002</td>
<td>CP</td>
<td>Postdoctoral Associate, Yale University, Immunobiology</td>
</tr>
<tr>
<td>Hejin Hahn</td>
<td>2002</td>
<td>AP</td>
<td>Pathologist, Virginia Mason Medical Center</td>
</tr>
<tr>
<td>Henry Haskell</td>
<td>2002</td>
<td>AP</td>
<td>Regional Medical Laboratory, Tulsa, OK</td>
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<tr>
<td>Richard Haspel</td>
<td>2002</td>
<td>CP</td>
<td>Assistant Professor HMS, Beth Israel Deaconess Medical Center</td>
</tr>
<tr>
<td>David Kindelberger</td>
<td>2002</td>
<td>AP</td>
<td>Director, Cyto and Surgical Pathology, ConVerge Diagnostic Services</td>
</tr>
<tr>
<td>Mary Kwaan</td>
<td>2002</td>
<td>AP</td>
<td>Fellow in Cytopathology, University Southern California, Los Angeles</td>
</tr>
<tr>
<td>Fabiola Medeiros</td>
<td>2002</td>
<td>AP</td>
<td>Physician (Colorectal Surgery), University of Minnesota Physicians</td>
</tr>
<tr>
<td>Jian Shen</td>
<td>2002</td>
<td>AP/CP</td>
<td>Pathologist, Providence Portland Medical Center, Portland, OR</td>
</tr>
<tr>
<td>Jason Smouse</td>
<td>2002</td>
<td>AP/CP</td>
<td>Pathologist, Boulder Community Hospital, Colorado</td>
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<tr>
<td>Kimberley Springer</td>
<td>2002</td>
<td>AP/CP</td>
<td>Duty Medical Examiner, OCME of Boston</td>
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<tr>
<td>Mingjian “James” You</td>
<td>2002</td>
<td>AP/CP</td>
<td>Assistant Professor, University Texas, MD Anderson Cancer Ctr</td>
</tr>
<tr>
<td>Ramy Arnaout</td>
<td>2003</td>
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<td>Jane Brock</td>
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<td>Joseph Carlson</td>
<td>2003</td>
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<td>Pathologist, Karolinska University Hospital, Sweden</td>
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<td>Martin Chang</td>
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<td>Pathologist, Mount Sinai Hospital, Canada</td>
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<td>Priscilla Shin-Ming Chang</td>
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<td>Jey-Hsin Chen</td>
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<td>Rachel Factor</td>
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<tr>
<td>Finny Kuruvilla</td>
<td>2003</td>
<td>CP</td>
<td>Principal, Clarus Ventures, Cambridge, MA</td>
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<tr>
<td>Julie Reimann</td>
<td>2003</td>
<td>AP</td>
<td>Dir, Dermatologic Molecular Path, Miraca Life Sciences, Newton, MA</td>
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<td>Rachel Rucker-Schmidt</td>
<td>2003</td>
<td>AP/CP</td>
<td>Pathologist, MD Pathology, Texas</td>
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<tr>
<td>Sandro Santagata</td>
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<tr>
<td>Jason Schmidt</td>
<td>2003</td>
<td>AP/CP</td>
<td>Pathologist, Methodist Health System, Dallas, TX</td>
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<td>David Wu</td>
<td>2003</td>
<td>AP</td>
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<td>Paula Abreu-e-Lima</td>
<td>2004</td>
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<td>Anders Berg</td>
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<td>Patricia Brunker</td>
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<td>Joanna Gibson</td>
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<td>Briana Gleason</td>
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<td>Patricia Brunker</td>
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<td>Samuel Katz</td>
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<td>Vikram Kumar</td>
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<td>Peter Sadow</td>
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<td>Lynette Sholl</td>
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<td>Jacqueline William</td>
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<td>Justine Barletta</td>
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<td>Manfred Brigl</td>
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<td>Michael Roh</td>
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<td>Adam Rosendorff</td>
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<td>Marianna Ruzinova</td>
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<td>Eric Synder</td>
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<tr>
<td>Oname Burlingame</td>
<td>2006</td>
<td>AP/CP</td>
<td>Pathologist, Associated Pathologists/PathGroup, Nashville, TN</td>
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<tr>
<td>Eleanor Chen</td>
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<td>AP/CP</td>
<td>Associate Pathologist, BWH Pathology</td>
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<td>Wai Chin Foo</td>
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<td>Junior Faculty, Dept Pathology, MD Anderson, TX</td>
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<tr>
<td>Matthias Hofer</td>
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<td>AP</td>
<td>Resident in Urology, Northwestern Univ/Feinberg Sch of Med</td>
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<tr>
<td>Stefan Kraft</td>
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<td>AP</td>
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<td>Nima Mosammaparast</td>
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<td>Research, Brigham and Women’s Hospital</td>
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<td>Stephanie Schulte</td>
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<td>Pathologist, Faulkner Hospital, Boston, MA</td>
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<tr>
<td>Elizabeth Steensma</td>
<td>2006</td>
<td>AP/CP</td>
<td>Resident in Surgery, MSU-KCMS, Kalamazoo, MI</td>
</tr>
<tr>
<td>Sacha Uljon</td>
<td>2006</td>
<td>CP</td>
<td>Research Fellow, BWH Pathology</td>
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<tr>
<td>Qinghong Yang</td>
<td>2006</td>
<td>AP/CP</td>
<td>Pathologist, Unipath, Denver, CO</td>
</tr>
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<td>Agoston Agoston</td>
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<tr>
<td>Javad Beheshti</td>
<td>2007</td>
<td>AP/CP</td>
<td>Pathologist in Washington</td>
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<tr>
<td>Li Chen</td>
<td>2007</td>
<td>AP</td>
<td>Faculty, Neuropathology Division, Johns Hopkins</td>
</tr>
<tr>
<td>Kevin Golden</td>
<td>2007</td>
<td>AP/CP</td>
<td>Fellow in Gastrointestinal Pathology, BWH Pathology</td>
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<tr>
<td>Adriana Herskovits</td>
<td>2007</td>
<td>CP</td>
<td>Research, BWH Pathology</td>
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<tr>
<td>Dick Hwang</td>
<td>2007</td>
<td>AP/CP</td>
<td>Pathologist, Virginia Mason, Seattle, WA</td>
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<tr>
<td>Anna Laury</td>
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<td>AP</td>
<td>Clinical Instructor, University of California, Los Angeles</td>
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<td>George Lin</td>
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<td>AP</td>
<td>Pathologist, Dept Lab Med, Geisinger Medical Center</td>
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<td>Scott Lovitch</td>
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<td>Elizabeth Morgan</td>
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<td>David Park</td>
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<td>AP/CP</td>
<td>Pathologist, Memorial Sloan Kettering (Hematopathology)</td>
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<td>Shakti Ramkissoon</td>
<td>2007</td>
<td>AP</td>
<td>Research/Clinical Fellow in Pathology, BWH Pathology</td>
</tr>
<tr>
<td>Tanya Rege</td>
<td>2007</td>
<td>AP</td>
<td>Pathologist, Miraca Life Sciences, Newton, MA</td>
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<tr>
<td>Cheryl Adackapara</td>
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