Department of Pathology & Immunology

The Department of Pathology & Immunology (http://pathology.wustl.edu) is involved in the clinical diagnosis and monitoring of disease, in the teaching of pathology and immunology, and in research on the molecular basis of disease and immunology.

The department is responsible through its divisions for studying the pathogenesis and the biochemical and anatomical basis of diseases. Pathologists do research on disease processes using molecular, genetic and structural analysis. Pathologists have the responsibility for the cytological and anatomical diagnosis of diseases and for developing novel structural and molecular approaches for the analysis of them, particularly cancers and infectious diseases. The divisions of Anatomic and Molecular Pathology (https://pathology.wustl.edu/divisions/amp), Immunobiology (https://pathology.wustl.edu/divisions/immunobiology), Laboratory and Genomic Medicine (http://pathology.wustl.edu/divisions/lgm) and Neuropathology (http://pathology.wustl.edu/divisions/neuropathology) have faculty involved in teaching, clinical service and research. Prominent areas of research include experimental diabetes, hematology, bone pathophysiology, cancer, and gastrointestinal and vascular pathology.

The department teaches an extensive course in the second year of the curriculum and presents a number of conferences that third- and fourth-year students can attend. The department also offers a number of clerkships. The course director of the second-year Pathology course is Erika C. Crouch, PhD, MD. Students can take clerkships in Autopsy Pathology, Surgical Pathology or Laboratory Medicine, or participate in the research activities of the faculty.

The Division of Immunobiology (https://pathology.wustl.edu/divisions/immunobiology) integrates immunobiology activities in the school. It is responsible for the teaching of immunology in the first year of the curriculum (Brian T. Edelson, MD, PhD, is the course director) and for conducting basic research in immunobiology and in the immunological basis of disease.

Many faculty in the department are involved in graduate teaching and participate in the various programs offered by the Division of Biology and Biomedical Sciences (http://dbbs.wustl.edu/Pages). The department has strong participation in the Immunology graduate program.

Website: https://pathology.wustl.edu

Degrees & Requirements

While the Department of Pathology & Immunology does not offer its own degree, some of the department's courses are open to students in the MD and MSTP (MD/PhD) programs. Further information about the MD and MSTP degrees can be found in the Degrees & Programs Offered (http://bulletin.wustl.edu/prior/2018-19/medicine/degrees) section of this Bulletin.

Research

Paul M. Allen, PhD
BJC Institute of Health, 8th Floor
Phone: 314-362-8758
Research in immunology. The recognition of antigen by T cells. We are investigating how the T cell receptor functions developmentally, biochemically and structurally. We utilize in vivo models to study the role of T cells in alloreactivity/graft rejection and inflammatory bowel disease.

Jacques U. Baenziger, MD, PhD
Kingshighway Building, 2nd Floor, Room 2423
Phone: 314-362-8730
Glycobiology, informational role of carbohydrates in protein targeting and reproductive endocrinology.

Jeffrey I. Gordon, MD
4444 Forest Park, 5th Floor
Phone: 314-362-7243
Genomic and metabolic foundations of symbiotic host-microbial interactions in the human gut; impact on obesity and malnutrition.

Michael McDaniel, PhD
3709 West Building
Phone: 314-362-7435
The focus of this laboratory is to study the function and growth of pancreatic islets in Types 1 and 2 diabetes. Mammalian target of rapamycin (mTOR) is a protein kinase that integrates signals from growth factors and nutrients to regulate DNA and protein synthesis. G protein-coupled receptor agonists, such as GLP-1, have been shown to enhance proinsulin biosynthesis and secretion, and stimulate cellular growth and proliferation. Our objective is to further explore the mechanisms of action of GLP-1 to enhance DNA and protein synthesis via mTOR in rodent and human islets. These studies are of fundamental interest in optimizing mTOR to induce cellular growth and proliferation to: (1) enhance pre- and post-islet transplantation in Type 1 diabetes and (2) prolong b-cell compensation in response to insulin resistance in Type 2 diabetes. b-cell failure in obesity-associated Type 2 diabetes is believed to correlate with the intracellular accumulation of lipids that contribute to defects in insulin secretion and maintenance of b-cell mass. Our studies have identified lipoprotein lipase in b-cells, a key enzyme for catalyzing the hydrolysis of lipoprotein-associated TAG, to produce free fatty acids (FFA) for local cellular uptake. We are also characterizing the effects of enhanced FFA
uptake through fatty acid transporters and determining the regulation of lipid droplet synthesis and breakdown by lipid droplet associated proteins. Recent studies suggest that FFA up-regulate mitochondrial uncoupling proteins proposed to dissipate the proton gradient across the mitochondrial inner membrane. The objective of this study is to delineate the link between FFA and b-cell mitochondrial dysfunction in Type 2 diabetes.

Kenneth M. Murphy, MD, PhD
Clinical Sciences Research Building, 7th Floor, Room 7766
Phone: 314-362-2009
Function of dendritic cells in T cell responses and anti-tumor vaccines.

Robert D. Schreiber, PhD
BJC Institute of Health, 8th Floor
Phone: 314-362-8747
Tumor Immunology and Cancer Immunoediting. Research on natural and therapeutically induced responses to tumors and definition of the molecular roles of interferon-gamma and interferon-alpha/beta in these processes.

Carl H. Smith, MD
St. Louis Children's Hospital
Phone: 314-454-6029
Placental transport and surface membrane structure and function.

Thaddeus S. Stappenbeck, MD, PhD
Clinical Sciences Research Building, North Tower, Room 1020
Phone: 314-362-4214
My lab studies the cause of inflammatory bowel disease, a condition that leads to spontaneous inflammation of the intestine. We study the mechanisms of host gene mutations as well as abnormalities in host-microbial interactions that drive this disease.

Steven Teitelbaum, MD
Barnes-Jewish Hospital
Phone: 314-454-8463
Cellular and molecular mechanisms of bone remodeling with particular emphasis on osteoclast biology as relates to pathogenesis and prevention of diseases, such as osteoporosis. We focus on integrin and cytokine biology utilizing a variety of genetically-manipulated mice.

John Turk, MD, PhD
6609 Wohl
Phone: 314-362-8190
Phospholipase A2 (PLA2) enzymes in regulating insulin secretion from pancreatic islet -cells, e.g., a novel iPLA2 that does not require Ca2+ cloned from rat and human islets that is involved in -cell secretion and proliferation. Studies of iPLA2, its post-translational modifications, and its interactions with other proteins involve mice that are iPLA2-deficient globally or in selected tissues, transgenic mice that overexpress iPL2 in -cells, and insulinoma cells with genetically manipulated iPLA2 expression. Mass spectrometric characterization of proteins and complex lipids is an important tool in these studies.

Emil R. Unanue, MD
BJC Institute of Health, 8414
Phone: 314-362-8748
Research in immunobiology/immunopathology. Examination of cellular interactions resulting in immune induction and cellular immunity. These cellular interactions are examined in normal immune responses and in autoimmune diseases. The focus is to identify the proteins responsible for activation of lymphocytes in Type 1 diabetes.

Herbert Virgin, MD, PhD
Clinical Sciences Research Building, Room 8849
Phone: 314-362-9223
We work on issues at the interface of virology and immunology by analyzing aspects of viral immunity, viral pathogenesis, and viral genetics that contribute to virulence and disease.

Mark A. Watson, MD, PhD
Clinical Sciences Research Building, North Tower, Room 1029
Phone: 314-454-7919
Our laboratory is interested in defining patterns of somatic gene mutation, gene expression, and quantitative tumor clonality that can be used to predict distant site metastases and therapeutic vulnerability in patients with lung and breast cancer. Experimental approaches use histopathological review, and next generation DNA exome and RNA sequencing (NGS) of primary cancer patient tissues, coupled with bioinformatics and statistical modeling to identify candidate biomarker patterns that may be useful for the clinical management of cancer patients.

Faculty

Anatomic and Molecular Pathology Division Head
Steven L. Teitelbaum, MD

Immunobiology Division Head
Gwendalyn Randolph, PhD

Laboratory and Genomic Medicine Division Co-Heads
Charles Eby, MD
Thaddeus Stappenbeck, MD, PhD

Neuropathology Division Head
Robert E. Schmidt, MD, PhD

Visit our website for more information about our faculty (https://pathology.wustl.edu/people) and their appointments.

A
Paul M Allen, PHD, MS
Robert L. Kroc Professor of Pathology and Immunology (primary appointment)
BS University of Michigan 1974
PHD University of Michigan 1981
MS University of Michigan 1977

Gaya K Amarasinghe, PHD
Professor of Pathology and Immunology (primary appointment)
Professor of Biochemistry and Molecular Biophysics
Professor of Molecular Microbiology
PHD University of Maryland 2001
BS City College 1997

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PHD Florida State University 2010

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Assistant Professor of Pediatrics
BS1 University of Wisconsin-Madiso 2005
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PHD University of Nebraska 2004
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PHD University of CA Berkeley 2001
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Professor of Molecular Microbiology
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BS University of Alberta 2002
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MD Tulane University 2013
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PHD Vanderbilt University 2011

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Professor of Ophthalmology and Visual Sciences  
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BA Washington Univ in St. Louis 1962  
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Interim Head of the Department of Pathology and Immunology  
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BS Duke University 1977  
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PHD Washington Univ in St. Louis 1995  
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UNKNOWN Brown University 1995

Takeshi Egawa, PHD, MD  
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PHD Osaka University 2002  
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MD University of Cincinnati 1989

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BS Cairo University 2004  
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BS University of Notre Dame 1992  
MD Medical College of Ohio 1996

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Professor of Biochemistry and Molecular Biophysics  
Professor of Molecular Microbiology  
PHD University of CA San Diego 1993  
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Assistant Professor of Medicine  
PHD Washington Univ in St. Louis 2004
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Director of the Center for Genome Sciences
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Professor of Developmental Biology
Professor of Medicine
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PHD Washington Univ in St. Louis 2016

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PHD Dartmouth College 2013

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MS Handong Global University 2006
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BA University of Rochester 1948
MD Washington Univ in St. Louis 1952

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Friederike H. Kreisel, MD
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MD Goethe University 1995

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Jack H Ladenson, PHD
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PHD University of Maryland 1971
BS Pennsylvania State University 1964

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MD National Taiwan University 2000

Daisy W Leung, PHD
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Associate Professor of Biochemistry and Molecular Biophysics
BS Amherst College 1997
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Cheryl Faye Lichti, D SC, BAS
Assistant Professor in Pathology and Immunology (primary appointment)
D SC Duke University 1993
BAS Hendrix College 1988

Chieh-Yu Lin
Assistant Professor of Pathology and Immunology (Pending Executive Faculty Approval) (primary appointment)

Heide Maria Lind, MD
Associate Professor in Pathology and Immunology (Pending Executive Faculty Approval) (primary appointment)
MD University of Iowa 1979

Chang Liu, MD, PHD
Assistant Professor of Pathology and Immunology (primary appointment)

MD Peking Union Medical College 2004
PHD Oregon Health Science Univers 2010

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PHD Imperial College 2003
MD National Yang-Ming University 1997

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BS Rust College 1995
BS2 Rust College 1995
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BA Goucher College 1998
PHD Washington Univ in St. Louis 2002
BS Goucher College 1998

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MD University of Cordoba 1984

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PHD Washington Univ in St. Louis 2012
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Howard Hughes Medical Institute Investigator in Pathology and Immunology
PHD Johns Hopkins University 1984
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BS University of Arizona 1978
PHD Johns Hopkins University Medic 1983

Rakesh Nagarajan, PHD, MD, BA1
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PHD Washington Univ in St. Louis 2002  
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BA University of Virginia 1994  
BA1 University of Virginia 1994  

Julie Ann Neidich, MD  
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MD George Washington University 1983  

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PHD Washington Univ in St. Louis 1995  
BS Univ of Wisconsin Madison 1985  

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Vice Chair of Pathology and Immunology for Faculty Development  
BS Cornell University 1982  
PHD Columbia University 1987  

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PHD Rutgers University 2004  
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BS Bradley University 1996  
MD University of Illinois 2004  
PHD University of Illinois 2002  

Richard J. Perrin, MD, PHD  
Assistant Professor of Pathology and Immunology (primary appointment)  
PHD University of Illinois 2001  
MD University of Illinois Chicago 2004  
BS Yale University 1992  

John David Pfeifer, MD, PHD  
Professor of Pathology and Immunology (primary appointment)  
Professor of Obstetrics and Gynecology  
Vice Chairman for Clinical Affairs of Pathology and Immunology  
BA University of California 1981  
MD University of California 1988  
PHD University of California 1987  

Gwendalyn Jan Randolph, PHD  
Unanue Distinguished Professor of Immunology (primary appointment)  
Professor of Medicine  
BS Temple University 1991  
PHD State University of New York 1995  

Alejandro Reyes  
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(pharm appointment)  

Jon H Ritter, MD  
Professor of Pathology and Immunology (primary appointment)  
MD University of Minnesota 1988  
BA Mankato St University 1983  

Nidhi Rohatgi, PHD  
Instructor in Pathology and Immunology (Pending Dean's Approval) (primary appointment)  
PHD All-India Inst of Medical Sci 2005  

Stephen Matthew Roper, PHD, MS  
Assistant Professor of Pathology and Immunology (primary appointment)  
PHD Medical University of Sth Car 2015  
BS Texas Tech University 2004  
MS Texas Tech University 2007  

Marianna B Ruzinova, MD, PHD  
Assistant Professor of Pathology and Immunology (primary appointment)  
MD Cornell University 2005  
PHD Cornell University 2004  

Souzan Sanati, MD  
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MD Iran Univ of Medical Sciences 1993  

Robert Edward Schmidt, PHD, MD  
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BA Washington Univ in St. Louis 1969  
PHD Washington Univ in St. Louis 1976  
MD Washington Univ in St. Louis 1976  

Robert D Schreiber, PHD  
Andrew M Bursky and Jane M Bursky Distinguished Professor (primary appointment)  
Professor of Molecular Microbiology  
BA State University of New York 1968  
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BS Saint Louis University 2006  
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Clinical Research Assistant Professor of Medicine
BS Washington Univ in St. Louis 1974
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BS Georgia Tech 2007
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PHD Saint Louis University 1986
BS University of Notre Dame 1980

Thaddeus S. Stappenbeck, PHD, MD
Conan Professor of Laboratory and Genomic Medicine (primary appointment)
Professor of Developmental Biology
BA Northwestern University 1987
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MD Northwestern University 1995

Sanjay Joshua Swamidass, MD, MA, PHD
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Associate Professor of Biomedical Engineering
BS University of California 2000
MD University of California 2009
MA University of California 2006
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Wojciech A. Swat, MS, PHD
Associate Professor of Pathology and Immunology (primary appointment)
MS University of Warsaw 1989
PHD University of Basel 1992

Steven L Teitelbaum, MD
Messing Professor of Pathology and Immunology (primary appointment)
Professor of Medicine
MD Washington Univ in St. Louis 1964
BA Columbia University 1960

Suzanne Renee Thibodeaux, MD, PHD
Assistant Professor of Pathology and Immunology (primary appointment)

MD Univ Texas Health Sci San Anto 2013
BS Tulane University 2005
PHD Univ Texas Health Sci San Anto 2011

Emil Raphael Unanue, MD
Paul and Ellen Lacy Professor of Pathology and Immunology (primary appointment)
MD Havana University 1960
BS Institute of Secondary Educati 1952

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BS Calvin College 1998
PHD University of San Diego 2006

William Vermi
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Ashley Viehmann Milam, PHD
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Mallinckrodt Professor of Pathology and Immunology (primary appointment)
Professor of Medicine
Professor of Molecular Microbiology
BA Harvard University 1977
MD Harvard University 1985
PHD Harvard University 1985

Xiaoxiao Wan, PHD
Instructor in Pathology and Immunology (primary appointment)

PHD University of MO Columbia 2015

Xiaoli Wang, PHD, MD, MS
Assistant Professor of Pathology and Immunology (primary appointment)
PHD University of Arkansas 2001
MD Third Military Medical Univ 1977
MS School Not Listed 1989

Mark A Watson, PHD, MD
Associate Professor of Pathology and Immunology (primary appointment)
BA University of Pennsylvania 1985
PHD Washington Univ in St. Louis 1992
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MD Eastern Virginia Med School 2006
BS University of CA Berkeley 1995
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Associate Professor of Pathology and Immunology (primary appointment)
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BA Princeton University 1975
MD University of North Carolina 1989
MS University of North Carolina 1978

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BS Eastern Illinois University 1975
PHD Va Polytechnic Inst & State U 1982
MS Purdue University 1977

Melanie Leann Yarbrough, PHD
Instructor in Pathology and Immunology (primary appointment)
PHD University of Texas Southwest 2009

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MD Hubei Medical University 1986
MS Capital U of Medical Sciences 1989
PHD Shanghai Medical University 1993

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PHD University of Strathclyde 2006

Wei Zou, MA, PHD
Assistant Professor of Pathology and Immunology (primary appointment)
MA Qingdao University 1994
PHD Hebrew University 2003

Courses
Visit online course listings to view offerings for M60 Path (https://courses.wustl.edu/CourseInfo.aspx?sch=M&dept=M60).

M60 Path 523 Immunology
The course consists of lectures, laboratory exercises and clinical correlations. It covers all aspects of the immune system, effector molecules, cells and their function, cellular interactions, vaccines, and immunological diseases. Two laboratory exercises focus on blood typing and allergy. Students will also meet in groups (20-25 students) with clinicians to discuss a variety of clinical cases that relate to the course material. Credit 37 units.

M60 Path 665 Pathology
This course is a comprehensive survey of the biology and morphology of human disease through a combination of lectures and laboratory sessions. The year begins with a review of basic disease mechanisms at the cellular and molecular level. Subsequently, the pathogenesis and characteristics of important diseases involving each organ system of the body are presented. During the year, students will become familiar with the methods of contemporary pathologic analysis. They will also learn how the results of pathologic studies are used in the clinical setting to establish diagnoses, to assess prognosis and response to therapy, and to evaluate the quality of patient care. Credit 115 units.

M60 Path 702 Laboratory Medicine Clerkship
This elective is designed to teach the student how clinical laboratory assays are used in the diagnosis of disease and to understand the quality assurance tools the laboratory utilizes to assure the reliability of tests. The four-week elective includes rotations through laboratories in clinical chemistry, clinical microbiology, transfusion medicine, molecular diagnostics and hematopathology. During the elective the student will have a daily schedule, which includes didactic sessions with senior staff and house staff. Particularly useful clinical skills to be acquired include: morphology of peripheral blood smears and bone marrow biopsies; interpretation of coagulation tests, biomarkers of cardiac damage and serum protein electrophoresis patterns. Also covered are appropriate use of blood component therapy, and therapeutic apheresis and identification of infectious organisms. Students will attend quality assurance meetings with senior staff, participate in microbiology rounds and present case discussions during this elective. Credit 154 units.

M60 Path 750 Surgical Pathology Clerkship
This elective is designed to familiarize students with the discipline of surgical pathology and to encourage the development of basic skills in gross pathology and histopathological interpretation. The Laboratory of Surgical Pathology at Barnes-Jewish Hospital receives a broad range of medical biopsy material in addition to specimens derived from the busy surgical subspecialty practices. As a result, this elective is beneficial not only for students considering a career in pathology, but also for students planning careers in internal medicine, surgery, obstetrics-gynecology, pediatrics, radiology, radiation oncology and dermatology. Students on this elective will (1) learn how patient specimens are received and processed, (2) acquire skills in the gross examination and microscopic diagnosis of disease through active participation and (3) learn the role of the pathologist in the preoperative, intraoperative, and postoperative care and management of patients. Students will function as junior house staff managing their own cases with supervision from residents, fellows and attending pathologists. Students may also wish to participate in ongoing research projects within the department as time, and interest, allows. The daily schedule for students begins at 8:00 a.m. with morning conference. In general, the student will be able to complete all gross examination and sign-out activities by 4:30 p.m. Students are welcome to stay beyond
4:30 p.m. to participate in any of the academic or other working activities of the division. Student time distribution: Clinical duties 65%, Conference/Lectures 15%, Major teaching responsibility: Attending staff, residents and fellows; Patients seen/weekly: N/A; On-call/weekend responsibility: None.

M60 Path 805 Autopsy Pathology
This full-time elective is designed to introduce students to autopsy pathology. Students will assist in performing autopsies, and together with the first-year pathology residents, will participate in all of the activities of the Autopsy Service including brain cutting, specialty microscopic conferences, and weekly autopsy case conferences. Students will be under the direction of senior pathology faculty.

M60 Path 807 Dermatopathology
The student will be involved in all activities of the dermatopathology service. These include review, discussion and signout of gross and microscopic skin specimens. Signout occurs each day with a team that includes an attending, fellow, and residents from both dermatology and pathology. The medical student will work closely with the residents and fellow to preview cases prior to signout. Dermatology Grand Rounds and dermatopathology lectures are held on Thursday mornings and are mandatory. In addition, dermatopathology slide review conferences are held on Friday mornings and are mandatory. Other learning opportunities include daily Consensus Conference, informal unknown slide sessions, weekly Dermatology Consult Clinopathologic Conference and monthly Cutaneous Lymphoma Conference and Journal Club. The primary goal of this elective is to acquire basic competence in the diagnosis of skin diseases at the microscopic level. A secondary goal is to acquire understanding of the structure and function of the laboratory at the technical, administrative and medical professional level as it pertains to skin specimens.

M60 Path 812 General Cytopathology
This elective is designed to familiarize students with the discipline of cytopathology and to encourage the development of basic skills. Cytopathology impacts many different areas of patient care and medical practice. The Cytopathology Laboratory at Barnes-Jewish Hospital receives a broad range of medical biopsy material in addition to specimens derived from the busy surgical subspecialty practices. As a result, this elective is beneficial not only for students considering a career in pathology, but also for students planning careers in internal medicine, surgery, obstetrics-gynecology, pediatrics, radiation oncology and dermatology. Students on this elective will learn how patient specimens are received and processed, acquire skills in the gross examination and microscopic diagnosis of disease through active participation and learn the role of the pathologist in the preoperative, intraoperative, and postoperative care and management of patients. Students will function as junior house staff managing their own cases with supervision from residents, fellows and attending pathologists. Students may also wish to participate in ongoing research projects within the department as time, and interest, allows. At the end of the rotation the students are required to do a formal case presentation for the residents, fellows and attending staff.

M60 Path 820 Surgical Pathology
This elective is designed to familiarize students with the discipline of surgical pathology and to encourage the development of basic skills in gross pathology and histopathological interpretation. The Laboratory of Surgical Pathology at Barnes-Jewish Hospital receives a broad range of medical biopsy material in addition to specimens derived from the busy surgical subspecialty practices. As a result, this elective is beneficial not only for students considering a career in pathology, but also for students planning careers in internal medicine, surgery, obstetrics-gynecology, pediatrics, radiation oncology and dermatology. Students on this elective will learn how patient specimens are received and processed, acquire skills in the gross examination and microscopic diagnosis of disease through active participation and learn the role of the pathologist in the preoperative, intraoperative, and postoperative care and management of patients. Students will function as junior house staff managing their own cases with supervision from residents, fellows and attending pathologists. Students may also wish to participate in ongoing research projects within the department as time, and interest, allows. At the end of the rotation the students are required to do a formal case presentation for the residents, fellows and attending staff.

M60 Path 825 Introduction to Neuropathology
The course is structured to give the student a full-time immersion in the specialty of neuropathology, including both neurosurgical and neuroautopsy-derived material. There are daily didactic sessions that cover the spectrum of neurological diseases, review gross and microscopic neuro-anatomy, discuss approaches to the diagnosis of nervous system disease, and point out the interrelationships of research to clinical problems. Multiple clinical conferences and diagnostic working sessions complement reading, use of a large microscopic divisional study set and project work. Time: 35 to 40 hours per week.

M60 Path 855 Diagnostic Hematopathology
Student electives in diagnostics of diseases of hematopoietic cells aims to foster understanding of acute and chronic leukemias, reactive conditions mimicking malignancies, and lymphomas affecting adults and pediatric populations. This diverse field involves multiple ancillary diagnostic tests such as immunohistochemistry, flow cytometry and genetic testing. This elective will offer medical students an in-depth insight into what goes behind the final pathologic diagnoses in hematologic...
malignancies before a treatment plan can be executed. This insight is crucial to understand the importance of correct diagnosis (the answer to the usual “What’s taking pathology so long?” comment) and accurate, timely communication of preliminary and final diagnosis to the clinicians. Under general faculty and fellow supervision, the students will be primarily responsible for handling of their own cases such as bone marrow biopsies, simple lymph node biopsies, ordering the required tests, dictating the final reports and communicating with the clinicians. They will also participate in several conferences per week including hematopathology consensus conference, weekly cytogenetic/molecular correlation conferences, journal club and interdepartmental bone marrow transplant and lymphoma conferences.

**M60 Path 860 Clinical Laboratory Medicine**

This elective is designed to teach the student how clinical laboratory assays are used in the diagnosis of disease and to understand the quality assurance tools the laboratory utilizes to assure the reliability of tests. The four-week elective includes rotations through laboratories in clinical chemistry, clinical microbiology, transfusion medicine and hematopathology. During the elective the student will have a daily schedule, which includes didactic sessions with senior staff and house staff. Particularly useful clinical skills to be acquired include: morphology of peripheral blood smears and bone marrow biopsies; interpretation of coagulation tests, biomarkers of cardiac damage and serum protein electrophoresis patterns; appropriate use of blood component therapy and therapeutic apheresis; and identification of infectious organisms. Students will attend quality assurance meetings with senior staff, participate in microbiology rounds and present case discussions during this elective.

**M60 Path 900 Research Elective - Pathology**

Research opportunities may be available. If interested, please contact the Department of Pathology and Immunology.