Washington University School of Medicine Bulletin, 1992-1993

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Cover: Washington University School of Medicine provides its students with an outstanding clinical education. Pictured at St. Louis Children's Hospital—one of the nation's top five pediatric health centers and one of Washington's major teaching hospitals—are Penelope G. Shackelford, M.D. with Fourth Year Student Sanford Reikes. Dr. Shackelford is president of the Washington University Medical Center Alumni Association.
### CALENDAR 1992-93

#### 1992

##### JUNE

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monday</td>
<td>Academic year begins for the Third and Fourth Year Classes.</td>
</tr>
<tr>
<td>5</td>
<td>Friday</td>
<td>Deadline for registration and initial payment of tuition and fees for the Third and Fourth Year Classes.</td>
</tr>
<tr>
<td>9, 10</td>
<td>Tuesday, Wednesday</td>
<td>United States Medical Licensing Examination, Step 1.</td>
</tr>
</tbody>
</table>

##### JULY

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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<tbody>
<tr>
<td>3</td>
<td>Friday</td>
<td>Independence Day observance.</td>
</tr>
<tr>
<td>10</td>
<td>Friday</td>
<td>End of Clinical Clerkship Final Examinations.</td>
</tr>
</tbody>
</table>

##### AUGUST

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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<tbody>
<tr>
<td>12</td>
<td>Wednesday</td>
<td>Orientation, matriculation, and initial payment of tuition and fees for the First Year Class.</td>
</tr>
<tr>
<td>17</td>
<td>Monday</td>
<td>Academic year begins for the First and Second Year Classes.</td>
</tr>
<tr>
<td>21</td>
<td>Friday</td>
<td>Deadline for registration and initial payment of tuition and fees for the Second Year Class.</td>
</tr>
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#### OCTOBER

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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<tbody>
<tr>
<td>2</td>
<td>Friday</td>
<td>End of Clinical Clerkship Final Examinations.</td>
</tr>
</tbody>
</table>

##### NOVEMBER

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Friday</td>
<td>First trimester ends for the Second Year Class.</td>
</tr>
<tr>
<td>9</td>
<td>Monday</td>
<td>Second trimester begins for the Second Year Class.</td>
</tr>
<tr>
<td>13</td>
<td>Friday</td>
<td>Deadline for payment of the balance of tuition and fees for the Third and Fourth Year Classes.</td>
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</table>

End of Clinical Clerkship Final Examinations.

##### DECEMBER

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Friday</td>
<td>First semester ends at 5 p.m. for the First Year Class.</td>
</tr>
<tr>
<td>19</td>
<td>Saturday</td>
<td>Winter recess begins at 1 p.m. for all classes.</td>
</tr>
</tbody>
</table>

#### 1993

##### JANUARY

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Monday</td>
<td>Winter recess ends at 8 a.m. for all classes.</td>
</tr>
</tbody>
</table>

Second semester begins at 8 a.m. for the First Year Class.

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>Friday</td>
<td>End of Clinical Clerkship Final Examinations.</td>
</tr>
<tr>
<td>15</td>
<td>Friday</td>
<td>Deadline for payment of the balance of tuition and fees for the First and Second Year Classes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Friday</td>
<td>Observance of birthday of Martin Luther King, Jr.</td>
</tr>
</tbody>
</table>
**FEBRUARY**

12  **Friday** Second trimester ends for the Second Year Class.

15  **Monday** Third trimester begins for the Second Year Class.

19  **Friday** End of Clinical Clerkship Final Examinations.

**MARCH**

3   **Wednesday** National Board Examination, Part III.

14  **Sunday** Spring recess begins for the First and Second Year Classes.

22  **Monday** Classes resume at 8 a.m. for the First and Second Year Classes.

30, 31 **Tuesday, Wednesday** United States Medical Licensing Examination, Step 2.

**APRIL**

2   **Friday** End of Clinical Clerkship Final Examinations.

9   **Thursday** Spring recess begins at 5 p.m. for the Third and Fourth Year Classes.

12  **Monday** Classes resume at 8 a.m. for the Third and Fourth Year Classes.

**MAY**

7   **Friday** Third trimester ends for the Second Year Class.

13  **Thursday** Academic year ends at 5 p.m. for graduating students.

   End of Clinical Clerkship Final Examinations.

14  **Friday** Commencement.

15  **Saturday** Academic year ends for the Third Year Class.

19  **Wednesday** National Board Examination, Part III.

21  **Friday** Second semester ends for the First Year Class.

**JUNE**

8, 9 **Tuesday, Wednesday** United States Medical Licensing Examination, Step 1.

**CLERKSHIP AND SIX-WEEK ELECTIVE PERIODS**

<table>
<thead>
<tr>
<th>Period Begins</th>
<th>Dates</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>June 1, 1992</td>
</tr>
<tr>
<td>II</td>
<td>July 13, 1992</td>
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<tr>
<td>III</td>
<td>August 24, 1992</td>
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<tr>
<td>IV</td>
<td>October 5, 1992</td>
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<td>V</td>
<td>November 16, 1992</td>
</tr>
<tr>
<td>VI</td>
<td>January 11, 1993</td>
</tr>
<tr>
<td>VII</td>
<td>February 22, 1993</td>
</tr>
<tr>
<td>VIII</td>
<td>April 5, 1993</td>
</tr>
</tbody>
</table>

**FOUR-WEEK ELECTIVE PERIODS**

<table>
<thead>
<tr>
<th>Period Begins</th>
<th>Dates</th>
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<td>A</td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
<td>July 27, 1992</td>
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<tr>
<td>D</td>
<td>August 24, 1992</td>
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<td>E</td>
<td>September 21, 1992</td>
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<td>F</td>
<td>October 19, 1992</td>
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<tr>
<td>G</td>
<td>November 16, 1992</td>
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<tr>
<td>H</td>
<td>December 14, 1992</td>
</tr>
<tr>
<td>I</td>
<td>January 25, 1993</td>
</tr>
<tr>
<td>J</td>
<td>February 22, 1993</td>
</tr>
<tr>
<td>K</td>
<td>March 22, 1993</td>
</tr>
<tr>
<td>L</td>
<td>April 19, 1993</td>
</tr>
</tbody>
</table>
THE STUDY OF MEDICINE AT WASHINGTON UNIVERSITY

HISTORY

The education of physicians at Washington University began in 1891. Under an ordinance enacted April 14, 1891, establishing a Medical Department of Washington University, the St. Louis Medical College (an independent medical college in St. Louis) was brought under the wing of the well-established University. The faculty of the college eagerly agreed to the union, stating “Most of the great medical schools of the world have always been integrant departments of universities, and the examples which America furnishes give added testimony to the fructifying influence of the contact of students and teachers of professional schools with the workers in universities.” Eight years later, the Missouri Medical College (another independent college in the city) also joined Washington University, and thus the two most famous medical colleges in the city were merged with the University.

In 1909, Abraham Flexner began a survey of 155 medical schools in the United States and Canada for the Carnegie Foundation for the Advancement of Teaching. The survey created a national sensation. Some schools collapsed; others pooled their resources, while still others reorganized. The Medical School of Washington University did not escape criticism. In the report Flexner made to Dr. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching and former professor of astronomy at Washington University, he said that one of two courses must be adopted: “The department must be either abolished or reorganized.”

Dr. Pritchett mailed the report to Robert S. Brookings, a St. Louis merchant who was president of the Board of Directors of Washington University. Brookings was shocked and immediately went to New York to see Flexner, demanding proof that the conditions were as bad as described. Both returned to St. Louis and the two men went through the School. In less than two hours, Brookings was convinced that drastic action was necessary if the School was to be one of the foremost institutions of medical education and research. The meeting in 1909 of Brookings and Flexner was of unsurpassed significance in the history of the Washington University School of Medicine, for it led to the complete reorganization of the School and the establishment of the present Medical Center. Abraham Flexner inspired the dream of a model medical school. Robert Brookings accepted the challenge, and with the energy and vision which characterized all his enterprises, made the dream a reality.

No time was lost in making changes. The Bulletin of the Medical School for July 1910, made the following statement: “The Corporation of the University, becoming convinced that in no other direction could greater service be rendered than through a great, modern medical school, determined to reorganize the School and to place it in the front rank of American medical institutions. It has called to the heads of a number of leading departments the ablest men it could secure.”

When Robert A. Barnes died in 1892, he left a will which directed the trustees of his estate to use $840,000 for the erection and equipment of a hospital “for sick and injured persons, without distinction of creed, under the auspices of the Methodist Episcopal Church, South.” Investigation by the trustees into the cost of building a modern hospital convinced them that the sum was not large enough to build an efficient, fireproof building, and they therefore invested the trust. By 1912 the value had increased to $2 million, a sum which permitted the building of a hospital and left an endowment greater than the original fund.

At the same time the trustees were studying hospital construction, Robert Brookings was studying medical schools. It was apparent to everyone concerned that the two projects, the building of a medical school and the construction of a modern hospital, were so interrelated that the purpose of each would be more successfully fulfilled by an affiliation. A medical school would provide a highly trained staff and would assure the most modern methods and superior laboratory facilities for the hospital. A teaching hospital would give patients superior care and, at the same time, provide the essential clinical experience consistent with modern medical teaching methods.

In the spring of 1912 construction was begun on the medical school and hospital buildings which today form the nucleus of the present center. The laboratories were moved from their old quarters in downtown St. Louis into the new buildings on Euclid and Kingshighway during the summer of 1914, and late in the fall of the same year the activities of the Washington University Hospital were transferred to Barnes Hospital. Concomitantly, the St. Louis Children’s Hospital, then located on Jefferson Avenue, became affiliated with the School of Medicine and moved to its new quarters in the Medical Center.

On April 28, 29, and 30, 1915, exercises were held to celebrate the completion of this group of buildings designed to promote the practice, the teaching, and the progress of medicine. The dedication ceremonies
marked what Dr. William H. Welch of The Johns Hopkins University called "one of the most significant events in the history of medical education in America." Robert S. Brookings, the one man most responsible for the reorganization, voiced the hope that "our efforts will contribute, in some measure, to raising the standard of medical education in the West, and that we will add, through research activities, our fair quota to the sum of the world's knowledge of medicine." These prophetic words have been realized. Fourteen Nobel laureates have been associated with the School of Medicine, and 19 have been elected to the National Academy of Sciences.

In the ensuing years the Medical Center has continued to grow, and now its facilities are among the best in the world. With the increase in the size of the physical plant there has come a substantial increase in the number of the faculty; the expansion has been made without compromise to the standards which marked the early development of the Medical Center. As a result, significant achievements in both research and clinical areas have been steadily recorded.

RESEARCH

In fiscal 1991, gifts to the medical school totaled $20.1 million. For the first time, medical school annual fund giving — unrestricted gifts that can go directly to priority needs — broke the million-dollar mark. In an economic era when philanthropy is almost universally down, annual fund giving to the medical school increased by more than six percent. And 38 percent of professional alumni made gifts to the School of Medicine, a rate unmatched by all but a few of the premier educational institutions in the country.

Government research and training support to the School of Medicine is distributed across more than 400 separate grants and contracts. The School of Medicine currently ranks fourth out of 125 medical schools in the amount of total funding provided by the National Institutes of Health and the Alcohol, Drug Abuse and Mental Health Administration:

<table>
<thead>
<tr>
<th>Institution</th>
<th>Funding (Million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univ. of Calif. - San Francisco</td>
<td>$154,569,036</td>
</tr>
<tr>
<td>Johns Hopkins University</td>
<td>$152,958,908</td>
</tr>
<tr>
<td>Yale University</td>
<td>$123,469,025</td>
</tr>
<tr>
<td><strong>Washington University</strong></td>
<td><strong>$113,907,127</strong></td>
</tr>
<tr>
<td>Univ. of Washington - Seattle</td>
<td>$113,841,403</td>
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<tr>
<td>University of Pennsylvania</td>
<td>$102,473,074</td>
</tr>
<tr>
<td>Duke University</td>
<td>$ 99,249,079</td>
</tr>
<tr>
<td>Stanford University</td>
<td>$ 98,715,703</td>
</tr>
<tr>
<td>Columbia University</td>
<td>$ 96,152,023</td>
</tr>
<tr>
<td>University of Michigan</td>
<td>$ 95,036,079</td>
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</tbody>
</table>

*Does not include the $12.3 million from the National Institutes of Health generated by School of Medicine full-time faculty at Jewish Hospital.

MSTP student Joel Solomon analyzes data in Jeanne Nerbonne's lab in the Department of Molecular Biology and Pharmacology.

Program Project and Center Grants for fiscal 1991 with total support of more than $33.7 million:
- Gastrointestinal Proteins Cell and Molecular Regulation
- Healthy Aging and Senile Dementia
- Alzheimer's Disease Research Center
- A Resource of Biomedical Mass Spectrometry
- Program Project in the Pathophysiology of Human Growth
- Dependence Liability of Psychotrophic Substances
- Epidemiological Genetics and Family Study
- Long Term Changes with Neurotransmitter Receptors
- Basic Mechanisms of Seizure Neurobiology, Genetic, Epidemiology and Alcoholism
- Physiological Adaptations to Exercise in the Elderly
- Core Grant for Vision Research
- Diabetes Research and Training Center
- Pathophysiology of Renal Disease and Uremia
- Specialized Center of Research in Thrombosis
- Computer-Aided Drug Design
- Eicosanoid Synthesis, Function and Regulation
- General Clinical Research Center (Adult and Pediatric)
- Brain and its Vasculature
- Nuclear Determinants of Therapeutic Response
- Human Genome Analysis with YAC Clones
- Yeast Artificial Chromosome-Based Genome Mapping
During the past year, Washington University School of Medicine investigators have brought decades of research to bear on cancer, communicable disease and sudden cardiac death, among many other ailments.

More than 120,000 new cases of prostate cancer are diagnosed each year, but a third are not detected until the disease has spread beyond the prostate, significantly reducing chances for a cure. A research team led by William J. Catalona, M.D., in the Division of Urologic Surgery, has identified slightly elevated levels of a specific protein in the blood of two-thirds of patients with early stage prostate cancer and markedly higher levels in more than one third. The team's research shows that a simple, inexpensive blood test, called the prostate specific antigen test, or PSA, is potentially more accurate than anything currently available. The earlier detection afforded by the test promises increased cure rates and improved quality of life for prostate cancer patients.

Late last summer, infectious disease specialist Robert P. Perrillo, M.D., published research findings that are now generally recognized as a major step toward a cure for hepatitis B, a debilitating, infectious and formerly incurable liver disorder. An intensive course of interferon therapy induced remission in 38 of 126 treated patients and completely cured 11 of the 38. Now, if physicians can reach patients soon enough, they can cure what otherwise would be a lifelong infection and a 100-fold greater risk of primary liver cancer.

School of Medicine physicians have developed a surgical technique that treats atrial fibrillation, a dangerously abnormal heart rhythm. The operation, called the Maze procedure, takes its name from the maze-like pattern of incisions the surgeon makes across the surface of the atria. These incisions block the chaotic electrical impulses that characterize this most common form of arrhythmia. The operation, developed by James L. Cox, M.D., and his colleagues, blocks abnormal electrical activity yet provides safe passage for the regular electrical impulses the heart needs to sustain its pumping.

School of Medicine physicians are redefining surgery by removing diseased, fist-sized organs through incisions no larger than the width of a single finger. Using laparoscopy — a minimally invasive technique that relies on video images from a tiny camera as a means of seeing inside the body — Ralph V. Clayman, M.D., Nathaniel Soper, M.D., and Louis Kavoussi, M.D., were the first to remove a diseased kidney through a tiny incision last June. The procedure may well become the standard for kidney removal, as it already is for gallbladders.

A conservative alternative to the conventional heart-lung transplant for pulmonary hypertension patients developed here by Joel D. Cooper, M.D., requires only one donor lung, solving the patient's problem and greatly increasing the supply of organs for those who sometimes must wait years for a cure.

The University has been issued a patent for breast implants of peanut oil encased in a thin membrane. The implant — being developed by Judy M. Destouet, M.D., Barbara Monsees, M.D., V. Leroy Young, M.D., and others — is a promising replacement for the all-silicone implants that can obscure X rays and interfere with the early detection of breast cancer.

Many of the school's neuroscientists — Joshua R. Sanes, Ph.D., Jeff W. Lichtman, M.D., Ph.D., and others — pursue their research at the molecular level. They study the formation, development and repair of the junctions, called synapses, between neurons and other cells. Other investigators led by Dennis W. Choi, M.D., Ph.D., and John Olney, M.D., concentrate on the neurotransmitters that facilitate communication between nerves and target cells. They have shown that excessive amounts of neurotransmitter are toxic to brain cells, a finding with implications for neurological disorders including Alzheimer's, Huntington's chorea, Parkinson's disease and stroke. A new center for the study of brain and spinal cord injury has been funded ($8 million over a five-year period) by Hoffmann-La Roche, Inc. and will be directed by Choi, who is head of the Department of Neurology.

The School of Medicine has been designated one of the Public Health Service's first four centers of investigation for the human genome initiative — a project with the goal of deciphering, at the molecular level, the complete genetic message of human beings. The designation brings with it a five-year grant with a first-year award of $2.3 million from the National Institutes of Health to establish a new Human Genome Center at Washington University. Among the biggest scientific undertakings in history, the Human Genome Project will decipher the genetic messages locked away in each of the body's cells. The Washington University project has three parts, each based on the power of Yeast Artificial Chromosome (YAC) technology that was developed at Washington University and is now considered a worldwide scientific resource. Through YAC technology, large portions of the human genome are introduced into yeast chromosomes that are adopted and then cloned by the plant. Because of their size, the clones can hold even large genes intact and can be overlapped to reconstruct maps of large parts of the human genome. At Washington University, there are three goals. The first is to locate a number of genes of special medical or research interest in YACs,
such as those that are responsible for the rejection of transplanted tissues. The other two projects have as their goals detailed maps of two human chromosomes, known as seven and X. Several of the genes on chromosome seven, including the cystic fibrosis gene and those that control the immune response, are involved in disease. Genes for hemophilia A and B, diseases of the adrenal gland, fragile X syndrome, and color blindness are located on the X chromosome. In 1991, a worldwide team of scientists mapped the fragile X site and, with the help of YACs, developed diagnostic tests for fragile X syndrome.

Philip D. Stahl, Ph.D., professor and head of the Department of Cell Biology and Physiology, found a new role for heteromeric G proteins, previously known for mediating chemical signals across cell membranes. Stahl showed that G proteins also play a role in causing endosome fusion within cells, a key step in the process cells use to destroy unwanted materials and incorporate beneficial materials.

M. Alan Permutt, M.D., professor of medicine in the division of metabolism, found the first genetic marker for non-insulin-dependent diabetes (NIDDM). Permutt showed a link between having one type of NIDDM and carrying a certain form of the gene for glucokinase, an enzyme critical for stimulating the production of insulin.

Research by Stanley J. Korsmeyer, M.D., on chromosomal rearrangement in childhood leukemia has turned up the first member of a new class of oncogenes: regulators of cell death. The Bcl-2 gene that Korsmeyer's laboratory is studying functions as an antidote to cell death.

Researchers are also studying the complex operation of T-cells in the human immune system. Research by Dennis Loh, M.D., suggests that the body employs a "training program" in the thymus gland, where T-cells that can't recognize the difference between host and foreign tissues are weeded out. Another group of investigators explores the body's early warning devices, including proteins of the complement system. Seminal research by John P. Atkinson, M.D., has shown that complement proteins are essential to a balanced immune system and also that the body's failure to eliminate them after an immune response may lie at the heart of autoimmune disorders like rheumatoid arthritis and lupus.

Recently, Washington University and Monsanto Company extended their eight-year research agreement for an additional four years, bringing the total funding commitment to nearly $100 million. The Washington University/Monsanto Biomedical Research Agreement, directed for the School of Medicine by David M. Kipnis, M.D., head of the Department of Internal Medicine, is one of the largest research collaborations between an American company and an American university. It provides a framework for university and corporate researchers to collaborate on investigations of proteins, peptides and other molecules that modulate cellular function.
The efforts of the School of Medicine are directed toward providing able students with a stimulating and challenging milieu in which they may acquire a thorough background in scientific medicine, as well as a deep understanding of the meaning of comprehensive medical care. In a field that is developing as rapidly as is medicine, education begun in medical school must serve as the foundation for a lifelong course of learning. As Sir William Osler pointed out some decades ago, a faculty, no matter how talented, can "only instill principles, put the student in the right path, give him methods, teach him how to study, and early to discern between essentials and nonessentials."

Students today are preparing to cope with a changing world and to contribute, in a constructive, considered way, to resolving the problems of medicine and of health care. To assist in that preparation, the faculty's mission is to preserve the
joy of learning and to foster a spirit of discrimination and creativity. It is hoped that all students will achieve this grounding during their years in the School of Medicine.

In summary, the Washington University School of Medicine and the institutions in the Washington University Medical Center are committed to providing patients with high-quality medical care in a concerned, compassionate way, to increasing medical knowledge through research, and to educating superbly qualified young men and women in the health professions.

**TEACHING FACILITIES**

The Washington University Medical Center, spread over portions of six city blocks, is located along the eastern edge of Forest Park in St. Louis. Along the western edge of the park is the Hilltop Campus of the University. A regularly scheduled shuttle bus, operated for the benefit of students, faculty and staff, brings the two campuses within 10 minutes of each other.

The Medical Center was incorporated in 1962. It now consists of the Washington University School of Medicine, Barnes Hospital, Jewish Hospital, St. Louis Children's Hospital, Barnard Hospital, and the Central Institute for the Deaf. Integral units of the Medical Center include the world-famous Mallinckrodt Institute of Radiology, the Institute for Biomedical Computing, and the Irene Walter Johnson Institute of Rehabilitation.

Unprecedented growth has occurred in the last eight years with the construction of four new buildings totaling 663,000 gross square footage. This expansion includes the new Medical Library and Biomedical Communications Center, the Clinical Sciences Research Building (CSRB), the East Building, and the 4480 Clayton Avenue Building. The three-tower, 10-story CSRB alone added close to 400,000 gross square footage, totally dedicated to research. The new Medical Library and Biomedical Communications Center was completed in the fall of 1989. The completion of this $14 million structure, consisting of 113,000 gross square feet, has enabled the expansion of its programs, as well as long-term growth of its collections. Even more importantly, it provides state-of-the-art information management. The 4480 Clayton Avenue Building will house Central Administration offices for the School of Medicine and the Department of Surgery. Despite this growth spurt, a planning process is underway to validate the need for additional space for research, ambulatory care, and teaching. This may result in wings to existing buildings and new buildings on strategic locations.

A network of pedestrian bridges that interconnect the CSRB, East Building, and Barnes, Jewish and Children's hospitals with the rest of the Medical Center has also been completed. This ability to move freely among facilities enhances the interaction of all Medical Center institutions, greatly benefiting research and patient care. In addition, major renovations to existing buildings is continuing; again the emphasis is on research facilities. Currently $50 million of renovation is underway.

The School of Medicine is divided into two segments. The clinical departments are on the west side of the Medical Center, adjacent to hospital and patient areas, while the preclinical departments are to the east. Research and instructional activities occupy the greater portion of the facilities, with more than 1.6 million gross square feet devoted to these activities. In the aggregate, the School now occupies over 3 million gross square feet of space.

The focal point of the preclinical teaching facilities is the McDonnell Medical Sciences Building, center of activity for entering medical students. The McDonnell Building, with 300,000 square feet of first-class research laboratories and classroom space, was made possible by James Smith McDonnell III, a generous benefactor of Washington University. Rising nine floors above-ground, it contains administrative offices and two lecture halls on the first floor. Multidisciplinary teaching laboratories for first- and second-year students, and offices and research laboratories for the seven basic science departments are located on the upper floors. Modern centralized animal quarters are housed in the basement. In addition, two floors (15,467 gross square feet) of Olin Residence Hall have been converted into student carrels, classrooms and conference offices.

The North and South Buildings, in which centered the work of several Nobel laureates, have been extensively renovated. Along with the Cancer Research Building, they continue to provide space for laboratories, offices, and some departmental facilities. The East Building houses an MRI (magnetic resonance imaging) facility containing a 20 kilogauss magnet, as well as a film library, computer installation and other components of the Mallinckrodt Institute of Radiology. Other facilities in the East Building include the Program in Physical Therapy, the medical bookstore, and several administrative office suites.

The clinical departments of the School of Medicine, housed in nine buildings, are connected by a pedestrian bridge to the preclinical facilities. Washington University medical students receive intensive clinical training, and the School's clinical program is acknowledged as one of the best programs in the country. Over a five-year period (1985-89), the Medical Center had more than 2.5 million days of care for patients in and outside the St. Louis area, and there were more than one million days of care in emergency room visits. In 1989, there were 1,743 operating beds among Barnes, Jewish, and St. Louis Children's hospitals. In addition, students may take clinical training at the St. Louis Regional Medical Center and St. Louis Veterans Administration Hospitals; both are served by full-time and part-time faculty members of the School of Medicine.

Medical students work with patients in all areas of clinical care. This "hands-on" approach for clinical
training, one-on-one with some of the top clinical faculty in the world, in a large, state-of-the-art medical center, makes the training at Washington University School of Medicine a vigorous and challenging experience.

The following facilities are owned or operated by Washington University.

Irene Walter Johnson Institute of Rehabilitation is a center for training personnel in rehabilitation procedures, for treatment of disabled persons in the St. Louis metropolitan area, and for research related to chronic diseases.

Oscar Johnson Institute for Medical Research occupies the top five floors of the McMillan Hospital. McMillan Hospital houses offices and research laboratories for the Departments of Neurology and Neurological Surgery, Ophthalmology and Visual Sciences, and Otolaryngology.

The Edward Mallinckrodt Institute of Radiology—An internationally recognized center of excellence in teaching, research, and clinical services in Radiology, the Institute is housed in a 13-story building with satellite units in the West Pavilion of Barnes Hospital, the East Building, and St. Louis Children's Hospital. MIR's facilities include two functioning cyclotrons and five magnetic resonance imaging scanners.

Renard Hospital—With consolidation of psychiatric patient-care services in the West Pavilion, this recently renovated eight-story structure provides additional office and laboratory space for the Department of Psychiatry.

St. Louis Maternity Hospital houses offices and research laboratories for the Departments of Obstetrics and Gynecology, Ophthalmology and Visual Sciences, and Otolaryngology. A new Perinatal Center and laboratories for research in the physiology of reproduction are located in this building.

West Building contains offices and research laboratories for the Department of Internal Medicine, as well as for the Department of Pathology.

David P. Wohl, Jr., Memorial Hospital (ten floors), opened in 1953, provides offices and laboratories for the Departments of Medicine and Surgery. Recently completed were facilities for a Cancer Center on floor three which is contiguous with companion facilities in the adjacent Barnard Hospital.

David P. Wohl, Jr., Memorial—Washington University Clinics are administered by Barnes Hospital and handle over 100,000 outpatient visits a year. Five floors of the building are devoted to the clinics and five floors to research facilities for several departments of the School of Medicine. This building is owned by the School of Medicine, with Barnes Hospital operating the recently expanded Emergency Room and the David P. Wohl, Jr. Memorial—Washington University Outpatient Clinics.

**Clinical Sciences Research Building**

The Clinical Sciences Research Building, consisting of 382,080 gross square feet of space, is the newest research facility at the Medical Center. The 10-story structure, constructed at a cost of $55 million, houses research laboratories for the School's clinical departments, the Howard Hughes Institute, and contemporary animal care facilities.

Further, the Clinical Sciences Research Building is the connecting link for a series of enclosed pedestrian bridges that tie the Medical Center together. These enclosed, environmentally-controlled bridges connect Jewish Hospital on the north, St. Louis Children's Hospital on the west, and the Wohl buildings and Barnes Hospital to the south.

**Institute for Biomedical Computing**

The Institute for Biomedical Computing is an inter-school organization that spans the School of Medicine and the School of Engineering and Applied Science. The Institute consists of: the Biomedical Computer Laboratory, the Medical Informatics Group, and the Center for Molecular Design, all of which have close ties with both Schools. The purpose of the Institute is to foster the development and application of advanced computing and engineering technologies to problems in biomedical science. In addition to its activities in collaborative research, the Institute serves as a focal point for interdisciplinary teaching and student research in areas not ordinarily included in conventional curricula.

The Institute has its primary location on the campus of the School of Medicine, but it also occupies the Edward L. Bowles Laboratory on the Engineering School campus. The Bowles Laboratory is adjacent to Computer Science, Electrical Engineering, and other departments of the School of Engineering. This provides an Engineering School location for research and teaching activities. The Institute creates opportunities for collaborations between the two campuses and encourages involvement of students in activities spanning the medical and engineering sciences.

**Library and Biomedical Communications Center**

Founded in 1911, the Washington University School of Medicine Library and Biomedical Communications Center is one of the oldest and most comprehensive medical libraries in the United States. It serves as an information center for the faculty, students, and staff of the Medical Center and, in addition, extends its services and resources to health professionals in the local, state, and national communities.

In 1989, the School's new Library and Biomedical Communications Center was completed. This state-of-the-art building integrates four components: the health sciences library, the media/computer center, the Medical Center archives and rare book collec-
tions, and a health information network that links regional, national, and international information resources. The eight-level, 114,000 square-foot structure has a capacity over 450,000 volumes and is one of the most technologically advanced health sciences libraries in America.

The Library collections include over 270,000 volumes and some 3,200 current subscriptions. The media/computer center makes available to users some 2,500 audiovisual titles, software, and learning tools. Its Archives and Rare Book Division includes some 16,000 volumes and such outstanding collections as the Bernard Becker Collection in Ophthalmology, the Goldstein Collection in Speech and Hearing, and the Parton Collection of the St. Louis Metropolitan Medical Society. The Archives of the Medical Center which includes records and private papers of the School, memorabilia, and oral histories of individuals who have made important contributions to American medicine. Among the manuscript collections are papers of William Beaumont, Joseph Erlanger, E. V. Cowdry, Evarts Graham, and Carl Cori.

The Library is a pioneer in technology application, and users will find most functions computerized. Through its BACS database, students and staff may access from their offices a variety of information sources, among them, the book and journal holdings of 34 libraries in the St. Louis area, Current Contents, and MEDLINE. The world's output of knowledge is reached through on-line access to over 250 computerized data bases covering the biological, health, social and physical sciences. The Library is an important component in a world-wide, computer-based information network. It is a gateway through which faculty, students, and the community may access and manage information, interact with one another, and interface with other computers.

For information on the Library's special services, the "Library Guide," "Library Newsletter," or Information Services Division (362-7085) may be consulted.

The Medical Center

The School of Medicine is part of a medical center of 1,767 operating beds and over 15,000 employees, providing over 493,000 days of care and more than 232,000 ambulatory care visits each year. Organized formally in 1962, the umbrella organization now known as the Washington University Medical Center consists of a strong confederation of private institutions committed to the pursuit of excellence in health care, teaching, and research. Students receive clinical instruction and gain experience in all divisions of the Medical Center.

Over the years, with the growing confidence of working together, the Washington University Medical Center has undertaken increasingly complex projects. Evidence of this is the massive redevelopment project under way in the 38-block area surrounding the Medical Center. Working closely with the neighborhood, the Washington University Medical Center Redevelopment Corporation has, over a 16-year period, provided impetus for new office buildings, laboratories, apartment buildings, commercial areas, renovated single dwellings, and many public improvements. To date, nearly $500 million worth of construction, renovation, and improvements have been completed or commissioned, with new construction by Medical Center institutions accounting for about 80 percent of this total. This program began its second 10-year phase in 1986.

Barnes Hospital, the largest hospital in the Medical Center, provides a major source of clinical experience for medical students. Barnes Hospital is licensed for 1,208 beds and includes teaching facilities for all clinical departments except Pediatrics. All activities of the School of Medicine and Barnes Hospital are closely integrated, and the hospital medical staff is composed exclusively of members of the School of Medicine. The 18-story Queeny Tower has seven nursing floors and five floors of doctors' offices. It also has three floors of ambulatory care rooms. The East Pavilion and a companion structure, the 18-story West Pavilion, house over 750 patient-care beds, over 50 operating rooms, a chronic renal dialysis unit, a 110-seat amphitheatre, doctors' offices, and additional facilities for the Mallinckrodt Institute of Radiology. The East-West Pavilion is one of the largest, most sophisticated tertiary medical facilities in the world.

Barnard Free Skin and Cancer Hospital is independently owned but is operated by Barnes Hospital. It is a 44-bed hospital for the care and treatment of patients who suffer from skin diseases and cancer or who are undergoing special tests in the Clinical Research Center.

St. Louis Children's Hospital was named one of the top five pediatric health centers in the country by a physician survey reported in U.S. News & World Report in 1990. Founded in 1879, Children's offers a complete range of subspecialty medical and surgical services to meet the health needs of newborns through adolescents.

Its main 235-bed facility includes pediatric and neonatal ICUs, research and clinical labs, a heliport, Emergency Unit with Level 1 trauma capability, ten operating rooms plus a same-day surgery suite. A renovated building on the campus houses support and administrative staff in a modern office complex.

Through affiliate relationships with five local hospitals, including Barnes and Jewish Hospitals in the Washington University Medical Center, St. Louis Children's provides tertiary care for pediatric patients of community hospitals in the region.

A poll of the nation's pediatric department heads placed St. Louis Children's Department of Pediatrics among the top three pediatric departments in the United States. Children's has more than 600 staff physicians with faculty appointments at the School of Medicine.
Among Children's specialized care programs are those for cancer and leukemia, speech and hearing disorders, cleft palate and craniofacial deformities, hereditary disorders, heart defects, seizures and neurological disorders and cystic fibrosis, asthma and other chronic breathing disorders. Children's has the only designated pediatric lung transplant program in the nation.

The Jewish Hospital of St. Louis is a 628-bed, acute-care teaching hospital, dedicated since 1902 to outstanding patient care and advance medical research. The 900-member medical staff includes full-time academic faculty, private physicians and dentists. Supporting the medical staff is a house staff of 150 fellows, residents and interns; and a dedicated complement of nurses, technicians, service and support personnel. As a full-service healthcare facility, the Hospital specializes in age-related illnesses, bone health, cancer, heart disease, Obstetrics/Gynecology, psychiatric disorders, radiation oncology, rehabilitation medicine, and colorectal and orthopedic surgery. As a research facility, the Hospital ranks seventh in the country for funding of independent hospital-based research by the National Institute of Health. Some examples of Jewish Hospital's leadership in patient care include establishing Missouri's first successful in vitro fertilization program and providing the world's first successful use of a defibrillator to restore normal heart rhythm via a phone line. The Hospital offers one of only a few bone health/osteoporosis programs in the country. It serves as a worldwide center for the study of psychiatric genetics and has the area's first hospital-based home care and rehabilitation-medicine programs.

Central Institute for the Deaf, an internationally known institution, provides facilities for research into hearing problems, maintains a school for deaf and speech-handicapped children, provides outpatient clinics for children and adults, and engages in a program of professional education for scholars in the fields of audiology, otolaryngology, and education of the deaf.

In addition to the above facilities which make up the Washington University Medical Center, the following are affiliated with the School of Medicine, and various members of the staffs hold University appointments.

- St. Louis Regional Medical Center—St. Louis City and St. Louis County, with 300 beds.
- Malcolm Bliss Mental Health Center, with 150 beds.
- Ellis Fischel State Cancer Hospital, Columbia, Missouri, with 110 beds.
- St. Louis Veterans Administration Hospitals, with 614 authorized beds.
- St. Louis Shriners Hospitals for Crippled Children, with 80 beds.

**CURRICULUM**

The curriculum is the product of prolonged and continuing study, by both faculty and students, of the present and probable future course of medical science and medical practice, and of the ways in which medical education can be kept abreast of this course. It is planned to provide students who enter medical school with diverse backgrounds and interests and who will undertake a wide variety of careers, with the basic knowledge and skills essential for their further professional development. Modern medical education can no longer hope to be comprehensive; it must be selective. Yet students must develop facility in the understanding and use of several related technical languages: those of anatomy, chemistry, physiology, and clinical medicine. They must share responsibility for the care of the patient. They must also learn how these areas of endeavor are interrelated, how the organization and needs of society influence the methods of providing medical care, and how new knowledge is acquired and old knowledge re-evaluated.

The curriculum includes a core experience based upon a sequence of courses that will introduce students to the broad panorama of medicine. The principles, the methods of investigation, the problems, and the opportunities in each of the major disciplines of medical science and medical practice are presented in such a way as to help students select the career best suited to their abilities and goals.

The elective program helps students to decide where their major interests lie. It also enables them to benefit from the wide range of specialized knowledge and skills found in the faculty. As there is not enough time for all students to be introduced to each of today's areas of specialization, the elective program permits them to select, according to their own desires, the areas they wish to explore or to study in depth.
Students in the sixth grade class at Ross Elementary School react strongly to lungs from smokers and livers from alcoholics. With them is second-year medical student Sabu Cherian, one of many students who participate in a drug education program for area schoolchildren.

**Humanities Program in Medicine**

The Humanities Program in Medicine is a University-wide program dedicated to providing students with a broadened exposure to areas other than the biological sciences during their medical education. These areas include clinical ethics, jurisprudence, history, economics, literature, and health policy. The Program is directed from the dean's office at the medical school and utilizes faculty located at the Hilltop Campus, medical school, law school, as well as extramural faculty.

The mission of the Program is to generate an appreciation of the relationship of human experience, culture, institutions and values to medicine and thereby help to educate professionals who will apply that understanding to their activities as practicing physicians, biomedical researchers, and/or medical administrators. The Program is an enhancement of an already strong curriculum in order to prepare medical students to pursue their professional careers more effectively.

The current curriculum includes required courses in each semester of the first year, plus a clinical ethics elective. Clinical ethics conferences are included throughout the third year's clinical clerkships in internal medicine, neurology and neurosurgery, obstetrics and gynecology, pediatrics, and psychiatry.

**Table of Credit Hours 1992-93**

As reported to the Liaison Committee on Medical Education, representing the Council on Medical Education of the American Medical Association and the Executive Council of the Association of American Medical Colleges, credit hours for courses are expressed in terms of clock hours—the hours per year of contact between faculty and students. These clock hours are not to be interpreted as semester or quarter hours.

First-year courses are taught during the 38-week academic year:

<table>
<thead>
<tr>
<th>Clock Hours</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>168</td>
<td>Gross Anatomy</td>
</tr>
<tr>
<td>52.5</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>61.5</td>
<td>Molecular Genetics</td>
</tr>
<tr>
<td>52.5</td>
<td>Cell Biology</td>
</tr>
<tr>
<td>24</td>
<td>Topics in Medical Humanities</td>
</tr>
<tr>
<td>28</td>
<td>Medicine in Modern Society</td>
</tr>
<tr>
<td>20</td>
<td>Biomedical Statistics</td>
</tr>
<tr>
<td>108</td>
<td>Histology</td>
</tr>
<tr>
<td>96.5</td>
<td>Physiology</td>
</tr>
<tr>
<td>41</td>
<td>Immunology</td>
</tr>
<tr>
<td>85</td>
<td>Medical Microbiology</td>
</tr>
<tr>
<td>145</td>
<td>Neural Sciences</td>
</tr>
<tr>
<td>20 to 24</td>
<td>Electives*</td>
</tr>
</tbody>
</table>

902 to 906 Total clock hours for the year

*A student must successfully complete two electives. An elective may range from 10 to 12 clock hours in duration.
Second-year courses are taught during the 36-week academic year.

<table>
<thead>
<tr>
<th>Clock Hours</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>Introduction to Clinical Medicine</td>
</tr>
<tr>
<td></td>
<td>Physical Diagnosis Core</td>
</tr>
<tr>
<td>7</td>
<td>Ophthalmology</td>
</tr>
<tr>
<td>7</td>
<td>Otolaryngology</td>
</tr>
<tr>
<td>10</td>
<td>Human Sexuality</td>
</tr>
<tr>
<td>41</td>
<td>Psychiatry</td>
</tr>
<tr>
<td>28</td>
<td>Radiology</td>
</tr>
<tr>
<td>13</td>
<td>Surgery</td>
</tr>
<tr>
<td>7</td>
<td>Rheumatology</td>
</tr>
<tr>
<td>17</td>
<td>Neurology and Neurosurgery</td>
</tr>
<tr>
<td>16</td>
<td>Developmental Biology (Peds)</td>
</tr>
<tr>
<td>7</td>
<td>Medical Sociology</td>
</tr>
<tr>
<td>5</td>
<td>Medical Ethics</td>
</tr>
<tr>
<td>245</td>
<td>Pathology</td>
</tr>
<tr>
<td>149</td>
<td>Pharmacology</td>
</tr>
<tr>
<td></td>
<td>Pathophysiology ***</td>
</tr>
<tr>
<td>20</td>
<td>PP Cardiovascular</td>
</tr>
<tr>
<td>15</td>
<td>PP Pulmonary</td>
</tr>
<tr>
<td>19</td>
<td>PP Renal</td>
</tr>
<tr>
<td>27</td>
<td>PP Metabolism-Endocrinology</td>
</tr>
<tr>
<td>24</td>
<td>PP Gastro Intestinal</td>
</tr>
<tr>
<td>28</td>
<td>PP Hematology</td>
</tr>
<tr>
<td>12</td>
<td>PP Oncology</td>
</tr>
<tr>
<td>19</td>
<td>PP Neuropathophysiology</td>
</tr>
<tr>
<td>24</td>
<td>PP Developmental Biology (Ob/Gyn)</td>
</tr>
<tr>
<td>8</td>
<td>PP Nutrition</td>
</tr>
<tr>
<td>33</td>
<td>PP Infectious Diseases</td>
</tr>
</tbody>
</table>

905 Total clock hours for the year

***Pathophysiology of Infectious Diseases will be integrated among Pathology, Pharmacology, Pathophysiology, and Introduction to Clinical Medicine.

Clinical Clerkship (Third) Year is a 48-week academic year.

<table>
<thead>
<tr>
<th>Clock Hours</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>462</td>
<td>Medicine Clerkship</td>
</tr>
<tr>
<td>154</td>
<td>Neurology/Neurosurgery Clerkship</td>
</tr>
<tr>
<td>231</td>
<td>Obstetrics/Gynecology Clerkship</td>
</tr>
<tr>
<td>38.5</td>
<td>Ophthalmology Clerkship</td>
</tr>
<tr>
<td>38.5</td>
<td>Otolaryngology Clerkship</td>
</tr>
<tr>
<td>231</td>
<td>Pediatrics Clerkship</td>
</tr>
<tr>
<td>231</td>
<td>Psychiatry Clerkships</td>
</tr>
<tr>
<td>462</td>
<td>Surgery Clerkship</td>
</tr>
</tbody>
</table>

1,848 Total clock hours for the year

Elective (Fourth) Year is a 48-week academic year.

To qualify for the Doctor of Medicine degree at Washington University School of Medicine, fourth-year students are required to participate in a minimum of 36 weeks of electives (full-time clinical or research courses). Two-thirds of the minimum required time for the Elective Year must be taken exclusively in residence in the Washington University School of Medicine elective course program. A complete listing of fourth-year elective offerings at Washington University School of Medicine is available through the Office of the Associate Dean for Curriculum. Students may participate in clinical electives of four and six weeks duration. If a student takes a research elective, that elective must be of at least 12 weeks duration.

A maximum of 12 weeks’ credit is allowed for full-time elective coursework taken at other academic institutions. These may be clinical or research electives. Students desiring credit for work to be done at other institutions must petition the Associate Dean for Curriculum and the standing subcommittee of the Committee on Academic Review and Promotions (CARP-III) for approval of the plan of study. Absolutely no credit will be granted for electives undertaken prior to subcommittee approval.

Credit may be given for elective work done at any point in the standard four-year Doctor of Medicine degree program so long as participation conforms to current elective guidelines and (a) the student is a duly registered, full-time student for a minimum of three years and nine months, including scheduled vacation time, and tuition is paid for four complete academic years; or (b) if transferring into the Second Year Class, the student is a duly registered, full-time student for a minimum of two years and nine months and tuition is paid for three complete academic years; or (c) if transferring into the Third Year Class, the student is a duly registered, full-time student for a minimum of 22 months and tuition is paid for two complete academic years.

Students are encouraged to take lecture-seminar elective courses, but such offerings are optional.

Total clock hours for the year 1,386

Remuneration for work done while participating in electives for credit is prohibited.

DEGREE PROGRAMS

The Washington University School of Medicine offers four programs leading to the M.D. degree: a regular four-year program, a five-year program, the M.A./M.D. program, and a combined M.D./Ph.D. program.

Doctor of Medicine, Four-Year Program

By conferring the M.D. degree, the University certifies that the student is competent to undertake a career as a doctor of medicine. It certifies further that, in addition to medical knowledge and skills, the graduate possesses qualities of personality—compassion, emotional stability, and a responsible attitude—
essential to an effective professional life.

A course of medical education for the M.D. degree ordinarily consists of a minimum of four years of study. Students recommended for the Doctor of Medicine degree must be of good moral character; they must have completed an entire academic course of instruction as matriculated medical students, they must have passed all required subjects or the equivalent and have received satisfactory grades in the work of the full academic course, and they must have discharged all current indebtedness to the University. Individuals applying for licensure must be at least 21 years of age.

At the end of the final academic year, students who have fulfilled these requirements will be eligible for the M.D. degree.

**Five-Year Program**

In addition to the regular four-year program leading to the M.D. degree and the M.A./M.D. degree, students are permitted to spend one additional year in an academic program in a medical or medically-related field. The program must be arranged with an academic advisor and is subject to the approval of the Committee on Medical Education.

**Four Schools Program**

This novel approach to developing physician scientists was begun by the Departments of Medicine at Washington University, Duke University, The Johns Hopkins University, and University of Pennsylvania. Students who participate in this unique program are awarded support for a five-year training program starting after the third year of medical school: one year of undergraduate research, two years of medical residency and two years of postdoctoral research. Student are allowed great latitude in shaping the research and clinical experiences within the Four Schools consortium. Financial support is also provided for the final year of medical school.

**M.A./M.D. Program**

Medical students who are interested in an intensive research experience may apply for admission to the M.A./M.D. Program after the first, second or third year of medical school. Students spend one year (12 months) working in the laboratory of the faculty member whom they have selected. Application to the program consists primarily of a student-prepared proposal for a significant and feasible project defined with the advice of the faculty mentor. The program requires submission of a thesis in the form of a publication-quality manuscript at the end of the year of research. Students completing the program will be awarded a Master of Arts degree at the time that the M.D. degree is conferred. Students accepted into this program qualify for a stipend during the research year. Additional information can be obtained from the Office of the Medical Scientist Training Program.

**M.D./Ph.D. Medical Scientist Training Program (MSTP)**

Washington University offers a combined M.D./Ph.D. program that utilizes the resources of the Division of Biology and Biomedical Sciences and the School of Medicine. This program, the Medical Scientist Training Program, is designed for students interested in careers in academic medicine. Its purpose is to provide the basic research training needed for careers at major medical schools and research institutions. The Program was started in 1969, is one of the oldest and largest in the country, and is currently authorized to accept 22 students per year. The Program, which is usually completed in six years, has been highly successful; more than 90 percent of those who have completed their residencies are actively involved in research programs at leading institutions.

All students in the Program receive financial support in the form of stipends (currently $13,600 per year) and tuition remission.

Only students who have spent an equivalent of at least one semester in a research laboratory should apply to the Medical Scientist Training Program. Applicants must meet the requirements for admission to both the School of Medicine and the Graduate School of Arts and Sciences, although the Graduate Record Examination is not required. In addition, students planning to concentrate in disciplines related to the chemical or physical sciences should have completed mathematics through calculus, physics and physical chemistry, and advanced organic chemistry. A course in differential equations is also recommended. For those students whose major interests are in the more biological aspects of medical science, the requirements for chemistry are less rigorous, but a strong background in mathematics and physics is important. Although most individuals enter the Program as first-year students, applications will be accepted from students in their first or second year at this medical school.

The Program consists of three parts: (1) Two years of the usual medical curriculum; (2) At least three years of original research toward a thesis to satisfy the requirements for the Ph.D. degree; (3) A final year which is the usual clinical year of the medical curriculum and is adjusted to each student's career goals. Since the fourth year at Washington University School of Medicine is entirely elective, the medical scientist will have taken the equivalent of that year during the graduate portion of the Medical Scientist Training Program. Students normally take the first two years of the usual medical curriculum before entering the graduate portion of the Program, but it is possible to begin research following completion of the first year of the regular medical curriculum. Either sequence will satisfy requirements for both the M.D. and Ph.D. degrees. Degrees are awarded upon completion of the entire program.

While the Medical Scientist Training Program includes all medical courses required for the M.D.
degree, it incorporates a high degree of flexibility for individuals through a wide range of electives and graduate courses as well as the large number of thesis programs available. Every effort is made to individualize each student's curriculum based on previous background and current interests. A student can be excused, by examination, from any of the regularly offered preclinical courses and may substitute either advanced coursework or laboratory research in the time made available. In this way, students may have an opportunity to carry out supervised research during the first two years. The members of the Medical Scientist Training Program Committee are available to students to help them decide on an individual curriculum and appropriate laboratory rotations.

The performance of each student is reviewed annually and a high scholastic standing as well as a commitment to research is expected.

Funding support begins when the student begins the Program, either on July 1 or at the beginning of the medical school year. Students are encouraged to begin the Program in July. For these students, the first week is spent visiting faculty in various departments and choosing a laboratory in which to carry out a short research project before beginning medical school classes.

Students in the combined degree program will complete the usual medical school courses in the first two years. They are expected to do a summer research project between the first and second years of medical school. The laboratories selected for summer research need not be those chosen for the Ph.D. portion of the Program.

Students will spend the third, fourth and fifth years satisfying the following requirements of the

Graduate School of Arts and Sciences for the Ph.D. degree:
1) Completion of graduate coursework;
2) Successful performance in qualifying examinations;
3) Execution of original research suitable for a dissertation;
4) Defense of the thesis.

Students are also required to carry out a one-semester teaching assistantship during this period.

The Ph.D. degree may be obtained in any of the programs of the Division of Biology and Biomedical Sciences that includes the Departments of Anatomy and Neurobiology, Biochemistry and Molecular Biophysics, Biology, Cell Biology and Physiology, Genetics, Molecular Microbiology, Pathology, and Molecular Biology and Pharmacology. These departments jointly provide training in the following interdisciplinary programs:

- Developmental Biology
- Evolutionary and Population Biology
- Immunology
- Molecular Biophysics
- Molecular Cell Biology and Biochemistry
- Molecular Genetics
- Molecular Microbiology and Microbial Pathogenesis
- Neurosciences

These programs draw together faculty from all of the departments listed and provide maximum flexibility for student training.

A series of monthly seminars are held for M.D./Ph.D. students that are conducted by medical scientists of the clinical departments. These seminars are aimed at stimulating student interest in clinical medicine and at increasing awareness of major research problems in clinical medicine.

A special tutorial for M.D./Ph.D. students facilitates their transition into the sixth year of the program, which is the clinical year of the normal medical curriculum. The intensive clinical training provided in the final year is the last formal requirement for the M.D. degree. Both the Ph.D. and M.D. degrees will be granted at the conclusion of this clinical year.

Application Procedure

Students interested in applying to the Medical Scientist Training Program must apply to Washington University School of Medicine, which participates in the American Medical College Application Service (AMCAS). Those who have applied to the medical school and have not received information regarding this program may request an application or obtain additional information by writing to:

Medical Scientist Training Program
Campus Box 8226
Washington University School of Medicine
660 South Euclid Avenue
St. Louis, Missouri 63110-9822
(800) 852-4625

MSTP Student Roderick McCoy.
Doctor of Philosophy Programs

The Division of Biology and Biomedical Sciences offers predoctoral programs in Developmental Biology, Evolutionary and Population Biology, Immunology, Molecular Biophysics, Molecular Cell Biology and Biochemistry, Molecular Genetics, Molecular Microbiology and Microbial Pathogenesis, Neurosciences, and Plant Biology. These educational activities are organized on an interdepartmental basis by the faculty of the seven preclinical departments of the School of Medicine, as well as the Department of Biology in the School of Arts and Sciences. All degrees are awarded through the Washington University Graduate School of Arts and Sciences. Additional information about the Divisional programs may be obtained by writing to:

Graduate Studies Office
Campus Box 8226
Washington University School of Medicine
660 South Euclid Avenue
St. Louis, Missouri 63110-9822
800-852-9074

APPLYING FOR ADMISSION

Washington University encourages application from and gives full consideration to applicants for admission and financial aid without regard to sex, race, handicap, color, creed, or national or ethnic origin. University policies and programs are nondiscriminatory. In the selection of applicants, the Committee on Admissions follows the Technical Standards for Medical School Admissions as recommended by the Association of American Medical Colleges. Copies of these Technical Standards are available on request by writing to the Associate Dean for Admissions. The School of Medicine is committed to recruiting, enrolling, and educating an increased number of students from racial minority and educationally deprived groups.

Preparation for the Study of Medicine

Entrance requirements to the School of Medicine are:
1. Evidence of superior intellectual ability and scholastic achievement;
2. Completion of at least 90 semester hours of college courses in an approved college or university;
3. Completion of the Medical College Admission Test of the Association of American Medical Colleges;
4. Evidence of character, attitude, interests, and motivation suitable for a career in medicine.

Chemistry, physics, and mathematics provide the tools for modern biology, for medicine, and for the biological basis of patient care. Thus, a firm grounding in these subjects is essential for the study of medical sciences. Entering students are expected to have had at least the equivalent of one-year courses at the undergraduate level in physics and biology; to have studied mathematics through integral calculus; and to have a background in chemistry, including organic chemistry. In selected instances, one or more of these prerequisites may be waived by the Committee on Admissions, but applicants are strongly advised to pursue their interests in these and in other areas of science.

A major goal of undergraduate college work should be development of the intellectual talents of the individual. This often involves the pursuit of some area of knowledge in depth, whether in the humanities, social sciences, natural sciences. At the same time, a diversity of background is encouraged in order to provide a necessary foundation for cultural development. Specific courses, other than the few in the natural sciences, are not presented as prerequisites because a great variety of courses may prepare students for the many roles they may play in their medical careers.

Application Procedure

The Washington University School of Medicine participates in the American Medical College Application Service (AMCAS) of the Association of American Medical Colleges. AMCAS provides a centralized system for applying to any participating medical school with only one application and one set of official transcripts of academic work.

The AMCAS Application for Admission, common to all participating medical schools, is distributed by the AMCAS and preprofessional advisors. Applicants are urged to file their applications as early as possible.

Applicants to the 1993 First Year Class must submit their AMCAS application so that it is postmarked no later than November 15, 1992. On receipt of the application from AMCAS, the Office of Admissions promptly forwards to applicants the additional materials that must be submitted to complete the application process. At this stage, a nonrefundable Application Service Fee of $50 is charged by the University. Once complete, the applicant's admission credentials are reviewed and independently evaluated by members of the Committee on Admissions. The Committee would like to interview every applicant, however, since this would involve several thousand applicants, it is physically impossible to accomplish. Therefore, selected applicants are invited for a personal interview, as well as a tour of the School of Medicine and the Washington University Medical Center. This visit provides an opportunity for the applicant to meet and talk with students and faculty members.

If an applicant is planning an interview trip which will include the St. Louis area, it is appropriate to write the Interview-Appointments Secretary, Committee on Admissions, Box 8107, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, Missouri 63110, to inquire if an interview has been authorized. Communication by facsimile is encouraged. The fax number for the Committee on Admissions is (314) 362-4658. The inquiry should be made at least three weeks in advance of the anticip-
Distinguished Student Scholarships

Attitude, motivation and maturity. The announcement well as an assessment of the applicant's character, demonstrated superior intellectual achievement as committee of the faculty and will be based on selection of Scholarship recipients will be made by a applications for scholarship consideration. Final School's 1993 First Year Class will be invited to file members of the entering First Year Class. In early fall Scholarship Program.

Full Tuition Scholarships

In 1978, the School of Medicine established a scholarship program which based selection on merit rather than financial need. As one of the first merit scholarship programs for medical students, the Distinguished Student Scholarship Program has recognized and rewarded academic excellence and personal achievement for 14 years. To recognize outstanding alumni of Washington University, the Medical Center Alumni Association created in 1989 the Distinguished Alumni Scholarship Program.

Both the Distinguished Alumni Scholarships and the Distinguished Student Scholarships are subject to annual renewal. Recipients of these scholarships are expected to maintain academic excellence. If a scholarship is not renewed, the student may file for financial aid from the School. For scholarship recipients who document financial need above the full-tuition scholarship, additional funds are available to provide support up to the total cost of education. Scholarship recipients may not concurrently participate in the School's Medical Scientist Training Program, Mr. and Mrs. Spencer T. Olin Fellowships for Women, or the Armed Forces Health Professions Scholarship Program.

Distinguished Student Scholarships

Five full-tuition scholarships are awarded annually to members of the entering First Year Class. In early fall 1992, selected applicants for admission to the School's 1993 First Year Class will be invited to file applications for scholarship consideration. Final selection of Scholarship recipients will be made by a committee of the faculty and will be based on demonstrated superior intellectual achievement as well as an assessment of the applicant's character, attitude, motivation and maturity. The announcement of the 1993-94 scholarship recipients will be made on April 12, 1993.

Distinguished Alumni Scholarships

Four full-tuition Scholarships are awarded annually to members of the entering First Year Class. The application procedure and selection process are the same as the above description for the Distinguished Student Scholarships. For the 1989-90 academic year, the first scholarships were named to honor Eugene M. Bricker, M.D., Alexis F. Hartmann, M.D., Carl V. Moore, M.D., and Mildred Trotter, Ph.D. The 1990-91 Scholarships recognized Justin J. Gordonnier, M.D., Paul O. Hagemann, M.D., Edward H. Reinhard, M.D., and Fred C. Reynolds, M.D. The 1991-92 Scholarships acknowledge John C. Herweg, M.D., Virgil Loeb, Jr., M.D., George Sato, M.D., and Hyman R. Senturia, M.D. Alumni named for 1992-93 are L.J. Fline, M.D., David Goldring, M.D., Charles W. Parker, M.D., and Jessie L. Ternberg, Ph.D., M.D.

Third Year Class Transfer Program

Each year the Washington University School of Medicine accepts 8 to 12 transfer students into its Third Year Class. This class enlargement is permitted because of the abundant clinical training facilities available in the Medical Center and because of the existence of a national need for such transfer positions. Transfer applications are accepted from well-qualified students who are enrolled in good standing and eligible to continue in their U.S. medical schools, who have a cogent reason for requesting transfer, and who have the full approval of the dean of their current school.

Transfer application forms for our 1993 Third Year Class are available on August 1, 1992. Application deadline is November 15, 1992. Those applicants selected for interview will be invited to visit the Medical Center. All applicants will be notified of the decision of the Committee on Admissions by April 15, 1993.

Inquiries should be directed to:

Third Year Class Transfer Program
Washington University School of Medicine
660 South Euclid Avenue—Campus Box 8077
St. Louis, Missouri 63110

FINANCIAL INFORMATION

Cost of Education

For the First-Year Class matriculant, tuition and housing rates for the 1992-93 academic year are listed below. Students who enter in 1992 will benefit from a tuition stabilization plan, which provides that their annual tuition of $19,800 will be constant over four years. The items listed below provide an estimate of the expenses for a single student in the 38-week First Year Class. The total of these figures suggests a basic minimum budget of approximately $27,082. Allowances for entertainment, travel,
clothing and other miscellaneous items must be added to this estimate.

Tuition (includes Student Health Service and Microscope Lending Plan) $19,800
Books, supplies, and instruments 1,416
Housing (single room, Olin Residence Hall) 2,290
Board (Medical Center cafeterias) 3,576

Student Health Service
The Student Health Service provides comprehensive health care, including hospitalization, for all students in the School of Medicine. Health insurance coverage for dependents of students can be arranged for an additional charge.

Long-term group disability insurance is provided for medical students. Coverage may be converted to an individual portable plan prior to graduation.

Microscope Lending Plan
Microscopes which meet the technical requirements set by the faculty are provided at no additional charge to each student in the First and Second Year Classes. The Plan saves the high cost of microscope purchase and makes available to them a superior quality instrument.

Registration, Payment of Financial Obligations, and Refunds
All tuition and fee payments are due and payable on the dates specified in the published calendars of the programs in the School of Medicine. Failure of a student to register on or before the date specified in the published calendar will result in a late registration fee of $50, to be added to the amount due. Any tuition and fee payments due from the student and not paid at the time of registration or on the specified due date will accrue interest at the lesser of: (a) the rate of one percent above the prime interest rate in effect on the first business day of the month in which that payment is due, or (b) the maximum lawful interest rate then in effect. Any amounts not paid when due plus accrued interest thereon must be paid in full within three months of the original due date. If a student fails to settle such unpaid amounts within three months of the original due date, the School of Medicine will not release the student's academic record or progress reports pending settlement of the unpaid account. A student who has not satisfied all past due financial obligations to the University one month before the end of the academic year will not be allowed to progress to the next academic year or graduate.

A student who withdraws from the School will receive a pro rata refund of tuition and appropriate fees. The refund will be based on the ratio of the class days enrolled (from the first day of classes to the termination date) to the total number of class days in the term for which tuition and fees were paid. It is understood that the date on which a student formally notifies the Registrar's Office in writing of the decision to withdraw from the School of Medicine shall be regarded as the termination date, with no retroactive clause to be accepted. A prospective date will be accepted, however. If tuition and fees were paid entirely or in part by financial aid from the School, the refund will be applied first to the total repayment of the accounts from which financial aid was drawn, with any remaining refund balance given to the student. Financial aid received in excess of the costs of tuition and fees must be refunded by the student to the School on the same pro rata basis as calculated for the tuition refund outlined above.

Financial Assistance
The ability to finance a medical education at Washington University does not influence the student selection process. As all students accepted for admission have proven scholastic ability, financial assistance is awarded solely on the basis of documented financial need which cannot be met by student and family resources. Students who consider themselves financially independent of their parents must arrange for loans to replace the amount of support parents are analyzed to have the potential to contribute. The School of Medicine's Office of Financial Aid (Box 8059) will assist students in making these arrangements.

At the time accepted students indicate they will matriculate in the School of Medicine, they may request an application for financial aid. The Financial Aid Form and other financial aid materials, information, and instructions will be sent to the students by return mail. The Financial Aid Form solicits information about the applicant and parents, including a detailed description of resources and liabilities. In addition, it requests information about the income, expenses, education, and employment history of the student's spouse (or spouse-to-be). The School asks that the form be completed promptly, within two weeks from date of receipt.

Official copies of the parents' and the applicant's U.S. individual income tax returns complete the data required for financial aid consideration. All information is held in strict confidence. Financial aid award decisions are made by the five-member Committee on Student Financial Aid, and applicants are notified of the award decision within two weeks of the date the processed Financial Aid Form is received.

Financial aid awards are credited toward payment of tuition and fees. Proceeds from loans may be disbursed directly to the borrower. The loan portion of an award will be funded through the resources of the School of Medicine or through the Stafford Loan program (formerly the Guaranteed Student Loan program). All loans awarded by the Committee are free of interest while a student is enrolled in the School. Financial aid awards are made for a given academic year. Students may reapply for financial assistance in succeeding years if they remain in good academic standing. Financial aid may cease in the event of nonpayment of tuition and fees.
academic and personal standing, and if there is continued financial need. Awards made to a student may vary from year to year, depending upon the student's needs and upon the availability of funds to the Committee. Students are responsible for filing applications for renewal of awards in the spring of each year.

The Committee holds that students receiving assistance have an obligation to notify the Committee in writing if their financial situation changes, for example, through employment or receipt of a scholarship not anticipated at the time the application was submitted.

First- and second-year students are urged not to accept employment during the academic year. A number of fourth-year students find employment in hospitals within the Medical Center. The Personnel Office provides assistance to students' spouses seeking employment.

Policy For International Students
The admission decision at Washington University School of Medicine is based on academic and personal merit and not on the ability of the student to pay the costs of education. However, individuals who are not citizens of the United States of America or who do not hold U.S. Permanent Resident Visa status are not eligible for financial aid due, in part, to regulations covering most programs used by the School to fund financial assistance. Therefore, in order for the School to complete the required documents which are necessary for issuance of a Visa, the student must document, by a date and in a manner designated by the School, that the necessary amount of funds, as established by the School, is available to pay the costs of education (tuition and living expenses) for the anticipated period of enrollment, normally four years. Documentation of the required amount of financial resources may be by a letter of credit or by deposit of funds in an escrow account with a bank designated by the School.

Standards for Satisfactory Academic Progress for Financial Aid Eligibility
Federal law and regulations require that all students receiving financial assistance from Federal Title IV funds maintain satisfactory academic progress. The following policy presents the standards adopted by the Washington University School of Medicine. The policy applies to all students receiving financial aid.

Academic requirements for the M.D. degree include the satisfactory completion of the curriculum designated by the faculty. The progress of each student working toward an M.D. degree is monitored carefully and at least once each academic year by the designated Committee on Academic Review and Promotions. The qualitative measure of performance is based on a Pass/Fail grading system for the first semester of the first year, and thereafter on an Honors/High Pass/Pass/Fail/Incomplete and Deficient grading system. A student who does not satisfactorily complete all course requirements may be permitted to remediate. In this case, a student assigned to an individualized program which deviates from the norm and who earns satisfactory qualitative assessment in all courses for which enrolled will be deemed to be making satisfactory academic progress. The individualized program permits a student to take one final makeup re-examination in a course which a student has failed.

The normal time frame for completion of required course work for the M.D. degree is four academic years. Due to academic difficulties or personal reasons a student may require additional time. In such situations, the Committee on Academic Review and Promotions may establish a schedule for that student which departs from the norm. To be considered to be making satisfactory academic progress, the student must complete the first two years of the curriculum by the end of the third year after initial enrollment. The Committees on Academic Review and Promotions will monitor the progress of each student at the conclusion of each academic year to determine that the student is making sufficient progress to meet the time limits as specified. A student not making sufficient progress will be deemed not to be making satisfactory academic progress.

A student may be granted a leave of absence for health reasons or personal reasons. The period of time for which the student has been granted a leave of absence shall be excluded from the maximum time frame expected for completion of the program.

Medical students who are accepted for transfer from other medical schools will be evaluated with respect to levels of academic progress attained and a determination will be made as to remaining years of financial aid eligibility. This determination will be coordinated among the Assistant Dean in Academic Administration, Associate Dean for Student Affairs, and the Director of Student Financial Aid.

A student failing to meet one or more of the standards of progress shall be placed on financial aid probation. While on probation the student may receive financial assistance for one trimester, semester or equivalent time period. At the conclusion of this period, the student must have achieved compliance with each standard.

A student who does not achieve compliance with each standard by the conclusion of the probationary period is suspended from financial aid eligibility. The Office of Student Financial Aid must notify a student of implementation of probationary status and/or suspension.

A student shall be reinstated for financial aid eligibility at such time as that student has completed satisfactorily sufficient course work to meet the standards of progress. A student on financial aid probation or suspension may appeal that status by indicating in writing to the Director of Student Financial Aid the existence of mitigating circumstances which should result in reinstatement of
financial aid eligibility. Each appeal will be considered on its merit by the Committee on Student Financial Aid.

The Director of Student Financial Aid shall have primary responsibility for enforcement of this policy. The Director shall provide in writing to each student at the time of initial enrollment a copy of this policy. The Director shall ascertain at the time of each disbursement of funds and prior to certification of a financial aid application that the student is in compliance with the policy.

**Scholarship Funds**

*Helen M. Aff-Drum Scholarship Fund.* Established in 1988 to provide scholarship support to financially deserving medical students.

*American Medical Association - Education and Research Foundation Medical Student Assistance Fund.* Begun in 1983, donors' gifts supplement the Foundation's gift to support excellence and contribution to the Distinguished Student Scholarships and Distinguished Alumni Scholarships Program.

*Dr. William Monroe Baker Fund.* Established in 1988 under the will of Miss Lola Baxton in memory of Dr. Baker to provide scholarship assistance to worthy students who would be otherwise unable to obtain a medical education.

*The Barnes Hospital Society Scholarships.* Established in 1989 by the attendance staff physicians of Barnes Hospital, one scholarship is awarded to a first-year student based on financial need, four book scholarships are awarded to first-year students based on financial need, and an additional four book scholarships are awarded to second-year students who demonstrated distinguished academic achievement in the first-year curriculum.

*Dr. William Joseph A. and Helene H. Bauer Scholarship Fund.* Created in 1987 by Dr. and Mrs. Joseph A. Bauer to provide scholarship support to academically well-qualified and financially deserving medical students.

*Albert G. Blanke, Jr. Endowed Scholarship Fund.* Established by a generous gift in 1982, the fund provides scholarship assistance for deserving students in the School of Medicine.

*Gilbert L. Chamberlain, M.D., Scholarship Fund.* Created in 1971 by Dr. Gilbert L. Chamberlain to be used to aid worthy students in acquiring their medical education.

*Cecil M. Charles—Nu Sigma Nu Medical Student Scholarship Fund.* Established by the Nu Sigma Nu Medical Fraternity in memory of Dr. Charles.

*Grace Strong Coburn Scholarship Fund.* Created in 1962 through the bequest of Mrs. Grace Strong Coburn for scholarships in the School of Medicine.

*T. Griswold Comstock Scholarships.* Established under the will of Marilla E. Comstock for students who would otherwise be unable to obtain a medical education.

*Arpad Csapo, M.D., Memorial Scholarship Fund.* Established in 1982 by Elise Csapo in memory of her husband, and by his friends and colleagues to provide assistance for students who have shown promise in fields relating to reproductive medicine.

*Distinguished African-American Students Scholarships.* Four-year full tuition scholarships are awarded to students in each First Year Class for academic excellence and personal achievement.

*Dr. Charles Drabkin Scholarship Fund.* Created in 1964 to provide financial assistance to medical students.

*Robert F. Fickel, D.D.S. Scholarship Fund.* Received in 1990 and given in memory of Dr. Fickel's uncle, W. H. Fickel, M.D. (12). Awards are made to students after their first year of study.

*Carl Fisch Scholarship Fund.* Created in memory of Dr. Fisch by his daughter, Marguerite F. Blackmer. Provides support to students who demonstrate financial need.

*Fiancé Medical Scientist Traineeship.* Established in honor of faculty member and alumnus, I. Jerome Fiancé, M.D. ’75, by the Harry Edison Foundation for support of a student in the Medical Sciences Training Program. The trainee supported during the 1991-92 academic year is Matthew Schreiber.

*Charles H. Geppert Scholarship Fund.* Established by Mrs. Mary Geppert in memory of her husband, M.D. ’57.

*George F. Gill Scholarship Fund.* Instituted in memory of a former clinical professor of pediatrics.

*Harvielle-Bailey Scholarship.* Established in 1970 under the will of Miss Isabel Bailey Harvielle as a memorial to Dr. Charles Poplin Harvielle and Dr. Steele Bailey, Jr., alumni of the School.

*Dr. Grace Fitts Memorial Fund.* Provides scholarship awards for deserving Washington University medical students.

*Jackson Johnson Scholarship Fund.* Provided through a bequest in 1930 from Jackson Johnson.

*Dr. Lorraine A. Johnsruad Scholarship Fund.* Established in 1983 as a memorial to Lorraine from her classmates, friends, and family to assist deserving medical students in the funding of their medical expenses.

*Henry J. Kaiser Family Foundation—Medical Century Club Scholarship Fund.* Following the Foundation’s generous gift in 1980 for medical student scholarships, the Medical Century Club accepted the challenge to raise new scholarship funds to match an additional gift from the Foundation.

*George D. Kettelkamp Scholarship Fund.* Established in 1969 by Mrs. Kettelkamp in memory of her husband, an alumnus of the School of Medicine.

*M. Kenton King, M.D. Scholarship Fund.* Created by the Executive Faculty to honor Dr. King at the time of his retirement in 1989 as Dean of the School.
of Medicine after having served in that position for twenty-five years.

**Albert F. Koetter, M.D., Scholarship Fund.** Established in 1978 by Mrs. Stella Koetter Darrow in memory of her father, an alumnus and former faculty member of the School of Medicine. At least one full-tuition scholarship is awarded annually on the basis of academic achievement and financial need.

**Anne L. Lehmann Scholarship Fund.** Established in 1983 to grant continued scholarship support to medical students.

**Life and Health Insurance Medical Research Scholarship Fund.** Established for the training of promising scholars intent upon a career in research and academic medicine. Trainees funded during 1991-92 academic year are: Jonathan Glickman; Theodore Ross; Sally Yorl; and, John Zempel.

**Life Insurance Medical Scholarship Fund.** Created in 1972 from residual funds in the Life Insurance Medical Research Fund, scholarship support is now awarded to students in the M.D. degree program.

**Maude L. Lindsey Memorial Scholarships.** Created in 1976 to assist students in the School of Medicine.

**John R. Lionberger, Jr., Medical Scholarship Endowment Fund.** Created in 1982 by Dr. John R. Lionberger to be used to aid worthy students in acquiring their medical education.

**Eliza McMillan Scholarship Fund.** Provides assistance to young women in any of several schools of the University to secure an education.

**Alma Mavis Scholarship Fund.** Created in 1988 under the will of Alma Mavis to assist students intending to practice family (general) medicine.

**Medical Center Alumni Scholarship Fund.** Awarded on the basis of academic achievement and financial need.

Roy B. and Viola Miller Memorial Fund. Created in 1963 through the bequest of Roy B. Miller to provide scholarships for medical students and for post-graduate students engaged in study and research in the medical sciences.

**The Warren S. and Dorothy J. Miller Scholarship Fund.** Established in 1982 through the bequest of Dorothy J. Miller to provide scholarships for any students engaged in studies leading to the degree of Doctor of Medicine and especially for those students with an aptitude and desire for the general practice in internal medicine.

**Joseph J. and Ernesta G. Mira Scholarship Fund.** Established in 1988 by Dr. and Mrs. Mira to provide assistance to students from the Alton, Illinois area, including the counties of Madison, Jersey, Calhoun, Greene and Macoupin.

**The Monsanto Scholars Program.** Established in 1990 with generous support from the Monsanto Fund. The Monsanto-Washington University Minority Medical Scientist Scholarship Program provides a monthly stipend and full tuition support for outstanding minority students who are committed to becoming academic physicians. Participants pursue both the M.D. and Ph.D. degrees in the six-year Medical Scientist Training Program (M.S.T.P.).

**Carl V. Moore, M.D. Scholarship Fund.** Earning both the A.B. and M.D. degrees at Washington University, Dr. Moore was internationally recognized for his medical research, teaching of medical students and residents, and patient care. As an administrator, he served the School as Dean for a period, was the first Vice Chancellor for Medical Affairs, and was the Bush Professor and Head of the Department of Medicine for seventeen years.
The Scholarship was created in 1992 by Mrs. Dorothy Moore in memory of her husband. It provides generous financial support each year to a student who documents financial need and superior academic achievement.

Dr. Helen E. Nash Scholarship for African-American Medical Students. $5,000 awarded for the first year of medical studies to an individual of demonstrated academic excellence, personal achievement and commitment to serve the African-American community. The scholarship honors Dr. Helen E. Nash, a Clinical Professor of Pediatrics, and a distinguished citizen of St. Louis.

Mr. and Mrs. Spencer T. Olin Fellowships for Women. Provides for annual financial support to women in any of several disciplines. Application deadline is February 1. The 1992 Fellows are: Rosalia Fonseca and Jennifer Payne.

Spencer T. and Ann W. Olin Medical Fellowships. Created in an effort to help fill the continuing shortage of physicians who pursue careers in biomedical research, the awards are primarily for students in the Medical Scientist Training Program. Trainees funded during 1992-93 are: James Amatruda, John Butman, Alan Cantor, Robson Hanson, David Simion and David Rudnick.

William B. Parker Scholarship Fund. Established in 1976 by the School of Medicine in honor of William B. Parker’s fifty-one years of service to the School.

The George M. (M.D. ’32) and George K. (M.D. ’64) Powell Medical Student Scholarship Fund. Established in 1984 by Mrs. George M. Powell in grateful appreciation for the medical education provided to her husband and son by the Washington University School of Medicine, which so positively affected the lives of the Powell Families.

Henry and Louise Reller Scholarship. To be given to medical students in the name of the parents of Louise Reller.

Samuel Jennings Roberts Scholarship Fund. Created to provide scholarships for any students engaged in study leading to the degree of Doctor of Medicine.

Robert Allen Roblee Scholarship Fund. Established in 1948 through the gift of Mrs. Joseph H. Roblee for students in the School of Medicine.

Thomas W. and Elizabeth J. Rucker Scholarship Fund. Created in 1950 under the will of Eugenia I. Rucker, in memory of her mother and father.

J. Max Rukes Scholarship Fund. Established in 1987, the fund provides scholarship support to deserving medical school students who are doing research in endocrinology or the chemistry of metabolism.


School of Medicine Scholarship Fund. Created in 1970 to provide financial assistance for medical students.

Dr. John B. Shapleigh Scholarship Fund. Established in 1926 with the bequest of Dr. John B. Shapleigh and supplemented by contributions from Mrs. Shapleigh and Miss Margaret Shapleigh.

Alexander Balridge Shaw Scholarship Fund. Created in 1958 through the bequest of Roy A. Shaw in memory of his father, Dr. Alexander Balridge Shaw.

Dr. Edward Hiroshi Shigeoka Scholarship Fund. Created in 1988 by Dorothy F. Shigeoka in memory of her husband, Dr. Edward Hiroshi Shigeoka, to help disadvantaged and deserving students pursue their careers in medicine.

Ernie Simms Scholarship Fund. Founded in 1984 by friends, colleagues, and former students of Professor Simms in recognition of his contributions to scholarly research and teaching in the Department of Microbiology and Immunology.

Beulah B. Strickling Scholarship Fund. Established in 1990 with a bequest from Mrs. Beulah B. Strickling.

Marleah Hammond Strominger Scholarship. Established in 1971 by the family and friends of Marleah Hammond Strominger. The recipient shall be a motivated student with need for financial assistance and shall come from a disadvantaged background.

Mary and Ernst Steuerle Scholarship Fund. Established in 1987, to assist medical students with documented financial need.

Edwin H. and Virginia M. Terrill Scholarship Fund. Established in 1962 with a bequest from Dr. Edwin H. Terrill, an alumnus. It was Dr. Terrill’s hope that scholarship recipients would repay into the Fund the amount of the award.

Mildred Trotter Scholarship Fund. For students of African-American heritage with documented financial need. The fund was established in 1979 by Dr. and Mrs. Paul Guttman, and supplemented by former students of Dr. Trotter, as a tribute to her many years of teaching in the Department of Anatomy.

Hiromu Tsuchiya Scholarship Fund. Created to provide scholarships in the School of Medicine.

Tuboske Jonas-Tuboske Medical Scholarship Fund. Established in 1984 by Rose T. Jonas in memory of her father, husband, and brother. The recipient shall be a senior student preparing to enter the field of surgery, obstetrics and gynecology, or internal medicine.

Dr. Cornelia M. Van Prooyen Scholarship Fund. Established in 1987, the fund provides scholarship support and other financial assistance to female medical students.

Dr. Howard Phillip Venable Scholarship for African-American Medical Students. $5,000 awarded for the first year of medical studies to an individual of demonstrated academic excellence, personal achievement and commitment to serve the African-American community. Dr. Venable, Clinical Associate Professor of Ophthalmology (Emeritus), has served as a member of the School’s Committee on Admissions, Committee on Student Financial Aid, and currently on the Minority Medical Student Scholarship Committee.
Louis H. Walikbe and Marie Walikbe Memorial Fund for Medical Education. Created in 1984 to provide scholarships and fellowships at the School of Medicine.

Dr. George S. Wilson Scholarship Fund. Established in 1988 with the bequest of Dr. George S. Wilson to provide scholarship support to medical students.

George and Irene Wolf Medical Scholarship Fund. Established by the donors to benefit students in the School of Medicine. The Fund began supporting students during the 1990-91 academic year.

George Zografakis Memorial Scholarship Fund. Created by the family and friends of Dr. Zografakis, a distinguished faculty member in the Department of Surgery.

Scholarship and Loan Funds

Isabel Valle Brookings Scholarship Fund. Established in 1957 by Isabel Valle Brookings (Mrs. Robert S.) for scholarships and loans in the School of Medicine.

Ruth Elizabeth Calkins Scholarship Fund. Established by Dr. Delevan Calkins in honor of his granddaughter.

Paul H. and Lila L. Guttman Student Aid Fund. Established in 1976 to provide financial assistance to qualified medical students.

Phi Beta Pi—Charles Ruggieri Scholarship Fund. Established in 1985 by the Washington University Alumni of the Phi Beta Pi medical fraternity to honor Charles Ruggieri and to assist deserving medical students enrolled in the Washington University School of Medicine with the funding of their undergraduate medical education.

William H. and Ella M. Scheue Fund. Established to provide financial assistance to worthy students in the medical school.

Loan Funds

Auer-Rosenfeld Memorial Loan Fund. Established by Mrs. Elizabeth Auer to be used for educational loans to students.

Jess K. Goldberg Memorial Loan Fund by Ophelia H. Kooden and Violet G. Sachs. Created in 1970 to provide loans for medical students in memory of the donors’ brother who passed away while attending medical school.

Health Professions Student Loan Fund. Established by federal legislation for medical students with a demonstrated financial need. Loans are available for long terms at favorable rates.

William Randolph Hearst Medical Scholars Loan Fund. In 1989, the Hearst Foundation provided first funding for a new and innovative loan program which provides interest-free loans to students in their last year of study.

Urals H. Walikbe Loan Fund. Established in 1987 by a bequest from Ursula Lee Hecker for the use and benefit of worthy, deserving, and needy medical students.

Horncrest Foundation—School of Medicine Loan Fund. In 1982, the Trustees of the Horncrest Foundation approved a proposal on behalf of the School of Medicine to match up to a generous annual cap for five years loan funds solicited by the School. The campaign was extremely successful and now provides loan funds to students with documented financial need.

W. K. Kellogg Foundation Loan Fund. Provides financial assistance to medical students in need of such aid.

Gustel and Edith H. Klewitt Scholarship Loan Fund. Provides loan funds for medical students.

Medical Scholars Loan Program. Established in 1985 by members of the William Greenleaf Eliot Society, this fund provides an interest-free source of long-term student loans. Annual contributions from alumni and friends support this perpetual and growing resource upon which current and future medical students will draw.

George W. Merck Memorial Loan Fund. Established in 1959 by The Merck Company Foundation, the original purpose of the loan was modified in 1983 to provide loans to graduating students which would help bridge the transition from student to resident physician.

Perkins Student Loan. A federal program (formerly National Direct Student Loan) to provide loans to students with financial need. Permits repayment over an extended period at a favorable interest rate.

Dr. William C. and Elka Pratt Loan Fund. Established in 1982 for medical students with demonstrated financial need.

G. H. Reinhardt Memorial Scholarship Loan Fund. Established in 1947 through the bequest of G. H. Reinhardt.

Aline Rixman Loan Fund. Created in 1940 by William Rixman in memory of his wife, the fund is used to alleviate unexpected financial emergencies of medical students.

Paul H. and Lila L. Guttman Student Aid Fund. Established in 1976 to provide financial assistance to qualified medical students.

School of Medicine Student Loan Fund. Established in 1969 to provide financial support for medical students.

George W. Merck Memorial Loan Fund. Established in 1959 by The Merck Company Foundation, the original purpose of the loan was modified in 1983 to provide loans to graduating students which would help bridge the transition from student to resident physician.

ASSESSING ACADEMIC ACHIEVEMENT

To assist students in evaluating their progress, each is graded in every course by the faculty. Courses in the first year curriculum are evaluated on a Pass/Fail basis. Grades of Honors and High Pass are therefore excluded from the valid grades listed below for first year courses. In the clinical and elective years, grades are accompanied by detailed descriptive comments characterizing each student’s performance. This type of evaluative data is of considerable assistance to the student applying for internship or residency training, since it permits the Associate Dean for Postgraduate
Training to give each hospital to which the student has applied a meaningful, comprehensive summary of the candidate's attributes, abilities, and performance.

At the conclusion of each academic year every student receives a grade report that indicates achievement in each course taken. When all the official grades have been received, the official transcript, in addition to listing courses and grades achieved, gives the grade distribution in each course. Grades are:

- **H** = Honors
- **HP** = High Pass
- **P** = Pass
- **F** = Fail
- **DF** = Deficient
- **I** = Incomplete

"Honors" is given for a truly outstanding performance, "High Pass" for very good work, and "Pass" for satisfactory work. "Fail" signifies clearly unsatisfactory performance. "Deficient" indicates a marginal performance with some deficiency that must be removed, and "Incomplete" denotes that course work has not been completed.

If a departmental coursemaster submits a grade of "Incomplete," "Deficient," or "Fail" for a medical student duly enrolled in any medical school course, the coursemaster will include an accompanying statement which contains the following information:

1. Student's name
2. Course title
3. Inclusive dates of course
4. Grade
5. Description of extent of academic encumbrance
6. Remedial action recommended to remove the academic encumbrance.

This type of statement will be submitted to the Office of the Registrar at the time student grades are reported and prior to the scheduled meetings of the various committees on academic review and promotions.

The grade of "F" or "DF" remains permanently recorded on the official academic record/transcript. The final grade reflecting a level of success in the course appears as an additional line entry on the record/transcript.

### Tutorials and Individualized Programs

The educational program is designed to meet the needs of all medical students in an individual and a personalized way. To help students who may be having academic difficulty, individual tutorials are offered. The School's experience is that tutorials enable students to handle course work with improved proficiency. Students who are found to have difficulties in handling the normal academic course load will be asked to take an individualized program which would require five rather than four years to complete.

### Rules Governing Promotions

A faculty Committee on Academic Review and Promotions ("CARP") reviews the records of all students by curricular level. Students must pass all required courses unless excused by the responsible department which must duly notify the Registrar of the Medical School. Students must have satisfactorily completed all the required courses for the first two years in order to proceed to the third year of the curriculum. No student may take more than three years to complete the coursework required for the first two years of the curriculum. "Three years" is defined as completed when the class with which the student entered commences WUMS IV, period two (usually the third week of July). In addition the student must have the intellectual, personal and moral qualities and the integrity, commitment and sense of responsibility appropriate for the practice of medicine.

Each student's performance will be evaluated periodically by a faculty Committee on Academic Review and Promotions. One such committee (CARP-I) is concerned with the first year, another (CARP-II) with the second year, and a third (CARP-III) with the clinical years of the curriculum. In the case of unsatisfactory progress, as evidenced by failing grades or an inability to develop adequate clinical expertise, the appropriate committee may require that the student be re-examined or repeat the relevant courses. If a student does not achieve or maintain a satisfactory level of scholarship, the committee may drop the student from the School.

Any action to drop a student from the School will be the result of a determination by a CARP committee (on the basis of the student's performance and on the judgment of the members of the faculty who know the individual) that the student has demonstrated an inability to successfully complete the requirements of the School for the degree of Doctor of Medicine.

A decision by a CARP committee to drop a student from the School may be appealed. The appeal must be submitted, in writing, to the Dean of the School of Medicine within 72 hours of the student's receipt of notification of the committee's decision. Appeals will be considered within 30 days by a standing Appeals Committee appointed by the Dean. The Appeals Committee has limited authority to uphold the earlier decision of the relevant CARP committee or to recommend to the Dean that the student be reinstated and allowed to continue his/her studies in the School. The reversal of a decision by a Committee on Academic Review and Promotions will be based only on a presentation of: (1) information which is new and/or different from that previously received by the CARP committee; or (2) evidence of extreme hardship of which the CARP committee was not fully apprised.

The Appeals Committee also serves for the Program in Occupational Therapy and the Program in Physical Therapy.

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**First-Year Students**

The medical school includes a Remedial Program for students who previously received by the CARP committee; or to recommend to the Dean that the student be reinstated and allowed to continue his/her studies in the School. The reversal of a decision by a Committee on Academic Review and Promotions will be based only on a presentation of: (1) information which is new and/or different from that previously received by the CARP committee; or (2) evidence of extreme hardship of which the CARP committee was not fully apprised.

The Appeals Committee also serves for the Program in Occupational Therapy and the Program in Physical Therapy.
First Year Curriculum

CARP-I is concerned with the first year of the medical curriculum. Failing grades, evidence of an inability to develop professional competence; and/or lack of those attributes of personality (personal and moral qualities and the integrity, commitment and sense of responsibility) deemed essential for professional life, constitute evidence of unsatisfactory progress. An action to drop a student will be the result of the committee’s determination (based on the student’s performance and in the judgement of the members of the faculty who know the individual) that the student has demonstrated an inability to complete successfully all of the requirements of the School of Medicine.

Periodically, each student’s performance in the first year of the medical curriculum is evaluated by CARP-I. CARP-I may recommend to any first semester student whose performance reflects difficulties with the required course work that he/she enter an individualized program. Such a recommendation will be based on a review of the student’s performance in the initial examinations in either or both of the following first semester courses: Biochemistry, Cell Biology, Molecular Genetics, and Gross Anatomy, and Biostatistics. The intent of such an individualized program is to afford the student an optimum prospect of successfully completing the requirements for the first year. In addition CARP-I may recommend to any first year student in the second semester whose performance reflects difficulties with the required course work that he/she enter an individualized program. Such a recommendation will be based on a review of the student’s performance in the initial examinations in the following second semester courses: Histology, Physiology, Neural Sciences, Microbiology, and Infectious Diseases. Students who accept the committee’s recommendation will, upon advice of CARP-I, be permitted to withdraw from certain course work taught in the first semester, prior to December 1, or certain course work taught in the second semester, prior to May 1; and will be eligible for tutorial help in the courses in which previously registered for the semester.

The educational program is designed to meet the needs of all medical students in an individualized and personalized way. To help students who may be having academic difficulty, individualized tutorials are offered. The School’s experience is that tutorials enable students to handle coursework with improved proficiency.

If a student should fail a course he/she will be allowed to either take a re-examination no later than the August preceding commencement of the following academic year; enroll in and successfully complete, at the level designated by the coursemaster, a summer course at a different institution; or repeat the course. Failure of the re-examination or failure to complete a summer course at the designated level of performance will result in the student having to repeat the course. Failure of repeated course(s) will result in being dropped from the School of Medicine.

Students are required to take all examinations and re-examinations at the specified time. A student may be excused for extenuating circumstances at the discretion of the coursemaster.

If at any time a student has received a fail in five or more courses he/she may be dropped from the School of Medicine at the discretion of the Committee on Academic Review and Promotions.

In the absence of extenuating circumstances, no student may take more than two years to complete the coursework required for the first year of the curriculum.

No Student may take more than three years to complete the coursework required for the first two years of the curriculum. “Three years” is defined as completed when the class with which the student entered commences WUMS IV, period two (usually the third week of July).

Second Year Curriculum

The second-year curriculum of the Washington University School of Medicine is divided into three twelve-week trimesters. Prior to the end of each trimester there is a reading period followed by an examination period. As soon as possible following each examination period, coursemasters in Pathology, Pharmacology, Pathophysiology and Preparation for Clinical Medicine report student grades to the Registrar’s Office. The Committee on Academic Review and Promotions-II then meets and reviews the academic performance of all students in the Second Year Class particularly those students who are reported as having academic problems. The following guidelines are suggested for the re-examination of students who have failed trimester examinations:

1. Since Pathology, Pharmacology, and Preparation for Clinical Medicine are year-long courses, and since each of the three trimester examinations is cumulative, re-examinations in these subjects are given only after the end of the academic year meeting of CARP-II.

2. If a student fails one or more subjects in Pathophysiology, re-examination(s) will be offered according to the following schedule:

<table>
<thead>
<tr>
<th>Failure(s) in</th>
<th>Re-examination Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimester I</td>
<td>Re-examination(s) will be given during the first week after return from winter holiday break.</td>
</tr>
<tr>
<td>Trimester II</td>
<td>Re-examination(s) will be given during the first week after the spring break.</td>
</tr>
<tr>
<td>Trimester III</td>
<td>Re-examination(s) will be given during the last week of the interacademic year break.</td>
</tr>
</tbody>
</table>

Unless special permission is granted by CARP-II, a student in the Second Year Class may take re-examinations in no more than two subjects (e.g.,
Pathophysiology of the Heart and Kidney, or Metabolism and Pathophysiology of the Lung) during each re-examination period. If a student fails initial trimester examinations in more than two subjects in Pathophysiology, re-examination(s) in these additional subject(s) must be deferred until after the end-of-the-academic year meeting of CARP-II.

3. At the end-of-the-academic year meeting of CARP-II, the academic records of all students in the Second Year Class will be reviewed. If a student has not taken an initial examination, or has not taken a re-examination in the subject(s) at the end of the appropriate trimester, the opportunity for examination or re-examination will be offered in each instance. CARP-II will determine for each student whether it is appropriate and practicable for the re-examination to be given during the last week of the three-week interacademic year period or whether the student should delay starting the clinical clerkship year for a variable time period for up to twelve weeks for the purpose of study and review. Students will be provided tutorial assistance as determined by CARP-II.

4. If a student has failed the initial examination and failed a re-examination in a section of Pathophysiology, at the discretion of CARP-II the student may either take a final re-examination at a prescribed time or repeat the course in the next academic year.

5. If a student, not on an individualized program, fails any final re-examination(s), CARP-II will determine whether the student should be dropped from the School of Medicine or permitted to repeat the specific course(s) during the next academic year.

6. The following rules pertain to students in the third year of an individualized program: At the end of Trimester-I, CARP-II may drop the student from the School if the student is failing two full-year courses (i.e., Pathology, Pharmacology, Preparation for Clinical Medicine) or one full-year course and two sections of Pathophysiology after opportunity for a re-examination, or one full-year course, one section of Pathophysiology and one WUMS I course. (If a student fails to take a scheduled re-examination, the result is recorded as a failure). At the end of Trimester-II, CARP-II may drop the student from the School if the student is failing two full-year courses or one full-year course and two sections of Pathophysiology after opportunity for re-examination following Trimester-I and/or Trimester-II. At the end of Trimester-III and the opportunity for re-examination before completion of the last week of the interacademic year break, CARP-II shall drop the student from the School if the student has failed two full-year courses or one full-year course and two sections of Pathophysiology. Students on individualized programs who have not completed successfully WUMS I and II coursework must remove all encumbrances by the start of the second six-week period of the clinical clerkship year, or be dropped from the School. Students in regular programs who have not completed all course requirements by the end of Trimester-III but who are in the second year of residence as full-time medical students, shall have the option of not commencing clinical work until period three in order to complete the re-examination procedure.

7. A student must take and pass or otherwise receive academic credit for all courses in the first two years of the curriculum before starting the clinical clerkships curriculum.

8. No student may take more than three years to complete the coursework required for the first two years of the curriculum. "Three years" is defined as completed when the class with which the student entered commences WUMS IV, period two (usually the third week of July).

**Beyond the Second Year Curriculum**

The Committee on Academic Review and Promotions-III meets several times each year to review the academic progress of all students enrolled in the clinical clerkship and elective years. This includes students in the regular four-year M.D. program, students taking a five-year M.A./M.D. degree program, students in the clinical portion of the Medical Scientist Training Program, those selected students with a prior Ph.D. degree who have been approved by the Medical Science Training Placement Curriculum Committee for individualized curricula and are now in the clinical training period of their program and all others who have successfully completed all aspects of the School's preclinical curriculum. Before the end of each academic year, the Committee meets and recommends to the Executive Faculty those students who, in the opinion of the Committee, are qualified to receive the degree of Doctor of Medicine. Specific rules are as follows:

1. All academic encumbrances must be removed in order for a student to be recommended for graduation.

2. If a student does not achieve or maintain a satisfactory level of scholarship as determined by one or more departments in the School of Medicine, CARP-III may require the student to repeat a clerkship or elective, take a re-examination or may drop the student from the School.

3. The granting of the Doctor of Medicine degree indicates that, in the opinion of CARP-III, the student has the intellectual, personal and moral qualities and the integrity, commitment and sense of responsibility appropriate for the practice of medicine.
The St. Louis Riverfront and Gateway Arch during the July 4th Veiled Prophet Fair.

ST. LOUIS

It comes as no surprise to residents—natives and newcomers alike—that St. Louis is considered to be among the 10 most livable areas in the United States. In health care, education, and transportation, St. Louis ranks among the top 20. For recreation, the lively arts, and great everyday living, St. Louis is a city of opportunity and variety.

The Gateway Arch—St. Louis' preeminent symbol—represents the joining of old and new on the historic Mississippi riverfront. Rising in front of a dramatic skyline, the Arch symbolizes St. Louis' role as the gateway to the West. Today, as in the past, St. Louis is a prominent cultural and commercial city, linking the north and south, east and west, through its traditions and its view of the future. The Arch itself, designed by Eero Saarinen, is a remarkable sculptural achievement and an incredible engineering feat, worthy of its dramatic setting. It frames the commercial center of downtown, and the Old Courthouse where in 1847 Dred Scott argued his right to be a free man.

Ambitious renovation and architectural experimentation characterize busy downtown St. Louis. The Old Post Office and the massive Romanesque Union Station have been revitalized. Union Station now houses a hotel and expansive shopping mall, inviting convention visitors and tourists to explore commerce St. Louis-style. New corporate headquarters buildings downtown display the variety of modern architecture evident in major metropolitan centers around the nation. Members of the Washington University School of Architecture consult with local firms in the creation of new structures and the refurbishing of the old. A new housing area in the fashionable Central

West End, home to the Washington University Medical Center, is the design of a School of Architecture professor.

Though the St. Louis area has nearly 2.5 million residents, living here is simple and affordable. You are never farther than a 20-minute drive from any place you want to go in the metropolitan area, especially from Washington University's central location in suburban St. Louis. A convenient, modern highway system and a simple city plan allow easy access to all parts of the city and its many activities.

A keynote to St. Louis is variety. Any taste in housing, cuisine, lifestyle, and leisure activities can be found in the greater St. Louis area, but St. Louis is less expensive than comparable cities. Effective buying incomes of St. Louis households are 14 percent higher than the national average. Attractive, affordable residential communities abound here, many of them within a two-mile radius of Washington University. The Central West End, University City, and Clayton—all of which border Washington University—provide attractive housing and recreational opportunities. To the north, small shops, galleries, and ethnic restaurants dot the main street of University City. Adjacent to the Washington University Medical Center and the Hilltop Campus is the Central West End, fashionable, trendy, and restored to its late-19th century grandeur. To the south are the elegant homes and multi-family dwellings of Clayton. Those who come to St. Louis to be associated with the University find apartments that range in price from $300-$800 per month, and purchase properties ranging from $80,000 and up, all in the immediate area. For those who desire a more suburban lifestyle, west St. Louis county is a growing and beautiful area.
Cultural Opportunities

Once settled, new St. Louisans discover the rich recreational and cultural life here. You see the effects of the St. Louis renaissance in its theatres, galleries, and festivals. The St. Louis Symphony, among the finest in the nation, performs at historic Powell Hall. Symphony members bring their skills to the community through teaching and chamber concerts as well. Several hold appointments in the Washington University music department. The music department also has close ties with the St. Louis Conservatory and Schools for the Arts (CASA), an institution offering high-level intense training in music and the arts. In the downtown area, the rich St. Louis traditions in jazz, blues, and ragtime music are continued in a number of lounges and clubs.

Broadway comes to St. Louis at the Fox Theatre, a $2 million renovation of a 1929 example of exotic cinema temple art. Galleries sprinkled throughout the area bring the most current in visual arts to St. Louis, and antique shops remind us of the past. St. Louisans tend to be avid movie goers. Supplemening the standard movie fare available throughout the metropolitan area are two theatres close to campus, the Tivoli and the Hi-Pointe, offering excellent foreign films.

When the St. Louis city art museum was built for the 1904 World's Fair, much of the Washington University collection was housed in it. Standing on a hill in Forest Park, the museum was called the jewel of the Fair. By 1929, it exhibited the entire University art collection and provided space for fine arts students and faculty shows.

Though in 1960 Washington University built its own museum—the Gallery of Art housed in Steinberg Hall—and moved its collection there, ties with the St. Louis Art Museum remain very close. Students in art and in business intern at the Art Museum working in arts management and gallery organization. St. Louis also features one of the world's fine sculpture gardens, Laumeier International Sculpture Park. The park has 60 large-scale sculptures representing artists of international renown. St. Louis has two major historical museums as well: the Missouri Historical Society in Forest Park and the Museum of Westward Expansion under the Gateway Arch.

Recreation

For recreation, St. Louisans may use any of 93 parks that dot the metropolitan area. In Forest Park, which lies between the two Washington University campuses, are the Art Museum, The Muny (an outdoor theatre), the famed St. Louis Zoo, municipal golf courses, tennis and handball courts, a skating rink, and acres of paths, picnic areas, gardens, and wooded groves. Tower Grove Park is in south St. Louis, and adjoining it is the Missouri Botanical Garden, world famous for its research, collections, and facilities. The Garden's professional staff hold positions on the Washington University faculty and make the extensive research facilities available to students.

Seventeen years old in 1992, the Opera Theatre of St. Louis has been enormously successful, nationally and internationally, bringing English-language versions of the classics and presentation of contemporary operas to the stage. The Repertory Theatre of St. Louis has an extensive annual season, which includes experimental works and traditional dramas. The Theatre Project Company, City Players of St. Louis, and the Black Repertory Theatre enrich the dramatic offerings available in the immediate area.

Farther afield, St. Louis residents find outdoor adventure in the countryside beyond the city. In the Ozark Mountains, on the rivers of Missouri, on the lakes of neighboring Illinois, variety abounds. Camping, hiking, floating, rock climbing, and caving are among the many possibilities within a few hours' drive of St. Louis. For sailors, there is Lake Carlyle in Illinois. And for those with rod and reel, the Missouri streams are made-to-order.

The Washington University Athletic Complex provides outstanding resources to athletes at every level of ability. Open to all members of the University community, it includes an 8-lane, 25-meter stretch pool, two complete gymnasiums, weight rooms, racquetball courts, a complete outdoor tennis complex, and a track complex. Built on the site of the 1904 Olympic games, this state-of-the-art facility offers recreational opportunities year-round for students, faculty, and staff.

For the spectator, St. Louis is a splendid sports
For over a century, it has hosted one of the oldest traditions in baseball—the St. Louis Cardinals. Dizzy Dean and the Gas House Gang, Lou Brock, Ozzie Smith, and Stan Musial are all part of Cardinal history.

The ice hockey book in St. Louis began when the Blues moved here in 1967. They have a winning history and play 40 games per year in the Arena.

**Employment**

St. Louis is a great place to work: job opportunities are varied and abundant, many companies are distinguished for their excellent working conditions, and commuting is easier than in many large cities.

Since the 1960s, the St. Louis area has enjoyed an influx of corporate headquarters and offices. Thirteen of the Forbes 500 companies have headquarters in the St. Louis area; more than 800 Fortune 500 firms have an office, and 8 of the Fortune 500 are headquartered here. In addition, major insurance, retail, transportation, and banking organizations are in St. Louis. Among the top firms in town are Anheuser-Busch, The Brown Group, McDonnell Douglas, Monsanto, Pet, and Ralston Purina—all founded in St. Louis. Since St. Louis is chosen so frequently as a headquarters location, many support services have grown around them—law, accounting, data processing, advertising, public relations, and design firms, as well as photographic and audio visual studios.

One of the very large employers is the Washington University Medical Center—composed of the School of Medicine and several teaching hospitals. Illustrative of the productive ties between university and community, the Monsanto Company supports molecular biology research at the School of Medicine and has contracted with Washington University for biomedical research.

The John M. Olin School of Business at Washington University enjoys a special relationship with the business community. As a laboratory for student study, for internship opportunities, and for permanent employment of business graduates, the St. Louis business community plays an integral role in the education of undergraduate and graduate business students. Faculty consultants work with corporations to explore new opportunities for growth and development of their firms. The local business and professional communities have also been very supportive of a new graduate internship program making part-time jobs available to advanced graduate students in the humanities and social sciences divisions of the Graduate School of Arts and Sciences.

Similarly, the School of Law has close ties with the St. Louis legal community and, through its clinical program, offers internships in private and local government offices and in state and federal courts. In addition, the law school is fortunate in the active and interested role of the local bar associations in the development of the school’s special programs.

The George Warren Brown School of Social Work is also linked in many ways to the St. Louis social work community. Students find practicum assignments throughout the area and faculty both do research and consult with local agencies.

A strong partnership exists between technologically based businesses and industries in St. Louis and the School of Engineering and Applied Science.

* A replica of a stern-wheeler steamboat on the levee in downtown St. Louis.
Engineering faculty members regularly undertake collaborative research and consulting projects with firms such as McDonnell Douglas, Monsanto, and Emerson. The cooperative education program gives undergraduate engineering students an opportunity to apply what they learn in the classroom in alternating periods of employment, both in St. Louis and nationwide. In addition, the School of Technology and Information Management, the division of the engineering school that reaches out to St. Louis' technical community, offers selectiv professional-practice degrees, which themselves have been shaped with corporate involvement.

In short, Washington University, though a national research university, enjoys a close, even special relationship with the St. Louis area.

**STUDENT LIFE**

**Housing**

Those who come to St. Louis to be associated with Washington University School of Medicine find apartments which range in price from $350-$650 per month, all in the immediate area. The Apartment and Housing Referral Services, located in Millbrook Square on the Hilltop Campus, maintains listings of housing appropriate for married and single students. For information, contact Apartment and Referral Services, 6926 Millbrook Blvd., Box 1059, St. Louis, Missouri 63130 (Telephone: (314) 935-5092).

The Spencer T. Olin Residence Hall, located at 4550 Scott Avenue in the Medical Center, has accommodations for approximately 200 single men and women. The building was made possible by generous gifts from Spencer T. Olin, alumni and friends of the School of Medicine. Olin Hall is planned for the convenience of students in the medical or paramedical sciences. Every effort is made to provide an atmosphere that not only aids them in meeting their study obligations, but also recognizes their privileges as graduate students.

The rates for rooms during 1992-93 are:

<table>
<thead>
<tr>
<th>School Year: Late August-May (Nine Months)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-room suite</td>
<td>$3,035</td>
</tr>
<tr>
<td>Single room</td>
<td>$2,290</td>
</tr>
<tr>
<td>Double room</td>
<td>$1,545</td>
</tr>
<tr>
<td>Large single</td>
<td>$2,740</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summer 1992: for Three Months</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-room suite</td>
<td>$935</td>
</tr>
<tr>
<td>Single room</td>
<td>$685</td>
</tr>
<tr>
<td>Double room</td>
<td>$465</td>
</tr>
<tr>
<td>Large single</td>
<td>$840</td>
</tr>
</tbody>
</table>

**Summer 1992: Weekly Rates for Student Visitor**

| Two-room suite                                    | $87   |
| Single room                                       | $78   |
| Double room                                       | $69   |

**Daily Rates for Visitors**

| Two-room suite (furnished)                        | $37   |
| Single room                                       | $29   |
| Single room (prospective student)                 | $26   |

**Parking**

Parking is available on lots owned and operated by the School of Medicine. These lots are located near Olin Hall and various other sites within the Medical Center. Construction is currently underway of a 1,500 car employee/student parking garage in the 4400 block of Clayton Avenue. The estimated completion date for this facility is November, 1992. An annual permit must be purchased for the use of any of the surface parking lots. These permits are available to students on a limited basis. If space is available, students also qualify to purchase monthly parking cards in the Washington University Euclid Garage.

**Student Health Service**

Entering students are required to have a medical examination prior to matriculation, and to show proof of immunity to measles (rubeola), rubella and mumps. Subsequent medical care is provided as long as enrollment is maintained in the School of Medicine. Physicians at the Student Health Service provide preventive health care and care for urgent illness. Emergency care is available at Barnes Hospital. Essential costs of hospitalization are covered, up to a maximum of $50,000 for any one injury or illness. The student or his/her family is responsible for meeting the costs of hospital care in excess of those paid by the Health Service.

There are no benefits for outpatient care away from the medical center. The responsibility of the Student Health Service for hospitalization and emergency care will end 30 days after an individual ceases to be an officially enrolled student.

Students may purchase coverage for dependents. Details of this plan are available at the Student Health Service.

**Disability Insurance**

All students are covered by disability benefits. Group coverage of $500 per month is provided for years 1 and 2. Coverage increases to $1300 per month in year 3 and to $2000 in year 4 ($1300 group coverage, $700 individual coverage). Fourth year students have the option of converting to portable individual contracts prior to graduation.
Student Activities

Medical School Jazz Ensemble
The “Hot Docs,” now in its thirteenth year of existence, is a fully instrumented big band jazz ensemble. The 20-member group, composed predominantly of Washington University medical students, residents, and attending physicians, rehearse weekly and perform at concerts and dances throughout the year. The band’s large repertoire spans several musical generations, with the music of Miller, Dorsey, Basie, and Gillespie as well as present day jazz and pop composers represented. The “Hot Docs” provide one of several ways students can continue to pursue long-time special interests in addition to their medical education.

Student Organizations
Students at Washington University School of Medicine are active participants in medical student organizations on the local, state and national levels. The American Medical Student Association (AMSA), the Student National Medical Association (SNMA), the American Medical Women’s Association (AMWA), the Medical Student Section of the American Medical Association (AMA), the Missouri State Medical Association (MSMA), and the Organization of Student Representatives (OSR) in the Association of American Medical Colleges (AAMC), provide forums for addressing the educational, social and political concerns of medical students. The School of Medicine supports student participation in these national organizations and provides on an annual basis funds for travel and other expenses.

On the local level, AMSA is the major student organization at the School of Medicine. The chapter’s annual activities include a speaker series and several community service projects. In recent years, the service projects have included an ongoing blood pressure screening program done in conjunction with the American Heart Association, presentations to St. Louis area high school students on the effects of alcohol and drug abuse, and the Perinatal Project, where students help educate pregnant women at a community clinic.

The newest AMSA project is an AIDS education effort called Students Teaching Aids to Students (STATS). This project sends trained medical students into local middle schools to teach about AIDS. The combined efforts of medical students, faculty, middle school teachers, parents, and speakers with AIDS have made STATS a very successful program.

Under the auspices of the Perinatal Project, students assist in providing prenatal education and well baby care to women from lower socioeconomic groups.

Students are also actively involved in the Public Health Care Project, providing health care to the indigent in local clinics; the Hunger Project, which collects food for the homeless; and the Drug Education Project, which provides education on substance abuse to inner-city fourth and fifth graders.

Intramural Program
Students enrolled in the Washington University School of Medicine enjoy an active and diverse Intramural (IM) Program. The IM Program offers students the opportunity to participate in a wide range of sports. Utilizing the state-of-the-art facilities in the University’s Athletic Complex, medical students pursue personal athletic interests and enjoy interaction with students enrolled in both undergraduate and graduate degree programs. The IM Program provides an excellent opportunity to socialize with colleagues as well as other graduate students. Differences in curricular demands among participants are considered in scheduling games so that neither academic nor athletic goals are compromised.

Traditionally, the School of Medicine is represented each year by teams or individuals in over ten intramural sports. During the 1990-91 season, medical student teams competed in men’s and women’s flag football, soccer, volleyball, cross country, basketball, swimming, softball and track and field as well as coed ultimate frisbee, volleyball, inner-tube water polo and softball. In addition, there are different levels of competition so that the needs of both the competitive and recreational athlete can be met.

The School has always made a strong showing in both the mixed and graduate school division, as evidenced by the many championship T-shirts team members sport.

Academic Societies
To foster communication between students and faculty, three academic societies—The Joseph Erlanger Society, The Carl and Gerty Cori Society, and the Oliver Lowry and Carl Moore Society—meet independently throughout the academic year to enjoy a social hour, dinner, and conversation stimulated by an after-dinner speaker. The Societies promote a collegial environment for the medical school’s diverse faculty and student body.

Program for Women in Science and Medicine
The Program for Women in Science and Medicine is designed to foster interaction among women at all levels at the medical school. The program sponsors a variety of informal discussions, receptions, and dinners with informative speakers throughout the academic year.

Student Research Fellowships
No matter what medical career is chosen, it will be essential for the student to evaluate and use fresh knowledge throughout his or her professional life. Student Research Fellowships in basic science or clinical areas, awarded each year to selected students who undertake research projects under the direction of faculty members, are an important part of the educational program. Research allows students to
discover firsthand the problems and rewards of obtaining and assessing new information, thus adding another dimension to their experience as investigators. Selected Medical School faculty members serve as advisors to students interested in special research opportunities.

Fellowships are available to students after acceptance into the School. Students with academic encumbrances are not eligible. All research must be carried out at the Medical School. They carry a stipend for an 8-week program. The research must be undertaken for a minimum of two months during the student’s free time or a vacation period. Application should be made to the Committee on Fellowships and Awards, Dr. M. Schlesinger, Box 8230.

**Awards and Prizes**

Washington University School of Medicine publicly recognizes and rewards at two annual events outstanding scholarship, research accomplishments and community service of individual students. In December, the Student Awards Luncheon acknowledges academic excellence earned during the first three years of study. As part of the festive commencement activities in May, graduates are recognized for meritorious research and clinical achievements accomplished during their medical school careers.

**Morris Alex, M.D. Prize.** Awarded each year to that medical student who is outstanding among his or her peers in the second-year course, Introduction to Clinical Medicine. The 1992 recipient: John Michael Neil.

**Alpha Omega Alpha Book Prize.** Awarded at the end of the fourth year to a member of the graduating class who has performed outstandingly for the entire medical course. The 1992 recipient: James John Stevermer.

**The American College of Physicians Michael M. Karl Book Award.** Presented annually to a member of the graduating class committed to a career in internal medicine in recognition of highest achievement in the field of internal medicine. The 1992 recipient: Jeff Thomas Chapman.

**American College of Physicians Clerkships Award.** Established in 1992 to be awarded to a student completing the third year of study with meritorious achievement in the internal medicine clinical clerkships.

**American Heart Association Research Fellowship Award.** Given for outstanding performance in the American Heart Association Medical Student Research Fellowship Program. The 1992 recipient: Steven Gregory Heiss.

**American Medical Women’s Association Janet M. Glasgow Memorial Achievement.** Citations presented to women medical students graduating in the top 10% of their class. The 1992 recipients: Janice Ruth Eitel, Mary Celeste McGuire Hall, Christine Mhorag Hay, Julie Anne Kwa, Anne Marguerite Moon, Astrid Marie Newell, Denise Marie Rankin, and Michelle Denise Semin.

**Alexander Berg Prize.** Awarded to the student presenting the best results in research in molecular microbiology. The 1992 recipient: Sahjay Arvind Desai.

**Jacques J. Bronfenbrenner Prize.** Provided by Dr. Bronfenbrenner’s students in memory of his inspiration as a teacher and scientist, and awarded to the member of the graduating class who, in the judgment of the Chairman of the Department of Medicine, has done the most outstanding work in infectious diseases or related fields. The 1992 recipient: Andrew Nathaniel Blatt and James John Stevermer.


**Dr. Harvey Butcher Prize in General Surgery.** Awarded annually, in memory of Dr. Harvey Butcher, to the member of the graduating class who, in the opinion of the Department of Surgery, shows the greatest promise for general surgery. The 1992 recipient: Sharon Shou Jen Lum.

**Kebar S. Chouke Prize.** Awarded at the end of the first year to a medical student who has demonstrated superior scholarship in anatomy. The 1992 recipient: Scott Merrill Pinter.

**Ciba-Geigy Award for Outstanding Community Service.** Recognizes a second year student who has performed laudable extracurricular activity within the community. The 1992 recipient: Li Kuo Kong.

**Carl F. and Gerty T. Cori Prize in Biochemistry.** Awarded at the end of the first year to the member of the class who has demonstrated superior scholarship in biochemistry. The 1992 recipient: Andrea Elena Bonny.

**Edmund V. Cowdry Prize in Histology.** Established in 1969 to honor Dr. Cowdry; awarded to a medical student in the First Year Class who has performed meritoriously in microscopic anatomy. The 1992 recipients: Corina Jo Norrbom and Jennifer Lynn Paterson.

**Antoinette Frances Davies Prize in Cell Biology and Physiology.** Awarded annually to a member of the First Year Class who has demonstrated superior scholarship in these fields. The 1992 recipients: Corina Jo Norrbom and Matthew A. Schreiber.

**Elisabeth L. Demonchaux Prize in Pediatrics.** Established in 1985, the prize is awarded annually to a graduating student who has done outstanding work in pediatrics. The 1992 recipient: Denise Marie Rankin.

**William Ellis Prize.** Established in 1990 by Dr. Ellis and awarded to a senior student in recognition of meritorious research in ophthalmology. The 1992 recipient: Andrew Nathaniel Blatt.
George F. Gill Prizes. One prize awarded at the end of the first year to a member of the class who has demonstrated superior scholarship in anatomy; one prize awarded to a member of the graduating class who has demonstrated superior scholarship in pediatrics. The 1992 recipients: Andrea Elena Bonny and Gregory Keith Finn.

Alfred Goldman Book Prize. Created in 1972 as an annual award in recognition of achievement in the study of medicine or, in the opinion of the faculty, has done outstanding clinical work or research in diseases of the chest or pulmonary physiology. The 1992 recipient: Robert Craig Quackenbush.

Max and Evelyn Grand Prize. Established in 1985 by Dr. M. Gilbert Grand, the prize is awarded annually to a medical student in the Fourth Year Class for excellence in opthalmic research or clinical ophthalmology. The 1992 recipient: Joseph William Spraul.


Ishiyaku EuroAmerica, Inc. Award. Awarded for the first time at graduation in 1985, selection is based on general academic excellence throughout the recipient's medical education. The 1992 recipient: Denise Marie Rankin.

Dr. J. E. Kirk Scholastic Award. Established in 1975 and awarded to a graduating student of high scholastic standing. The 1992 recipient: Christine Mhorag Hay.

Louis and Dorothy Kovitz Senior Prize in Surgery. Senior award prize in surgery recognizing a member of the Fourth Year Class who has shown the most outstanding ability, zeal, and interest in surgical problems. The 1992 recipient: Brian Scott Funaki.


J. Wallace Leibner, M.D. Award. Established in 1988 in memory of Dr. Leibner, the award is given to the member of the graduating class who has demonstrated outstanding ability in the clinical practice of medicine. The 1992 recipient: Christine Mhorag Hay.


Howard A. McCordock Book Prize. Awarded at the end of the second year to a member of that class for general excellence in pathology. The 1992 recipient: Anand Shrikant Dighe.

John A. McDonald Prize. Awarded annually to recognize outstanding research by a trainee in the Respiratory and Critical Care Division.


Edward Massie Prize for Excellence in Cardiology. Awarded to the member of the graduating class who, in the judgment of the Director of the Division of Cardiovascular Disease of the Department of Medicine, has done the most outstanding clinical or basic research work in the field of cardiovascular disease. The 1992 recipient: Mark Eric Leimbach.

Medical Center Alumni Scholarship Prize. Given annually to a student who has shown excellence in his or her work during the preceding year. The 1992 recipient: Judith Eunkyung Cho.

Medical Fund Society Prizes. One prize awarded annually to a student of the Fourth Year Class who has excelled in the study of internal medicine; one prize awarded annually to a student of the senior class who has excelled in the study of surgery. No individual is eligible for both prizes. The 1992 recipients: Sanford Todd Reikes and Julie Anne Kwa.


Minority Medical Students Scholarship Prize. Provided by Black alumni and friends of Washington University School of Medicine, the prizes are awarded to Minority Scholarship recipients in recognition of their achievements in the first-year curriculum. The 1992 recipient: Robert Eugene Burke.

Missouri State Medical Association Award. A scroll and a U.S. Savings Bond presented annually to an honor graduate of the senior class. The 1992 recipients: Karen Jane Baranski, Judith Eunkyung Cho, and Jane Marie Lingelbach.

The Needleman Award. Established by his family in 1989, in honor of Dr. Needleman, Chairman of the Department of Pharmacology, 1976-1989. This annual award is given to a member of the graduating class for outstanding research in pharmacology. The 1992 recipient: David Patrick Martin.


James L. O’Leary Prize for Research in Neuroscience. Given annually to a predoctoral or postdoctoral student for the most original and important accomplishment in neuroscience research.

Dr. Phillip Rosenblatt Award. Given to a third year medical student for writing best essay on the subject of Pathology.

Washington University Internal Medicine Club Book Prize. Awarded to the member of the graduating class who has done the most significant research in any area of internal medicine. The 1992 recipient: Charlotte Justine Roberts Kennedy.

St. Louis Pediatric Society Senior Prize. Presented to the senior student showing the greatest promise in clinical pediatrics. The 1992 recipient: Joyce Gallagher Brashaw.

Sandoz Award. Given annually to a graduating student who has made a meritorious contribution to psychiatric research. The 1992 recipient: Steven Arthur Harvey.

Sidney L. Schwab Prize in Psychiatry. Awarded at the end of the fourth year for general excellence in psychiatry.

John R. Smith Memorial Fund Prize. Created in 1982 to be awarded annually to a medical student who has done meritorious clinical and/or research work in the Division of Cardiovascular Disease of the Department of Medicine. The 1992 recipient: Robert Walter Mandal.

Margaret G. Smith Award. Given to a woman medical student for outstanding achievement in the first two years of medical school. The 1992 recipient: Sally Jane York.

Samuel D. Sotile Award in Obstetrics and Gynecology. Presented to a member of the Third or Fourth Year Class for meritorious achievement in either basic or clinical investigation in obstetrics and gynecology. The 1992 recipient: Joan Lewis Blomquist.

Upjohn Achievement Award. Given to the fourth-year student who has done the most meritorious work during his or her medical school career in the field of metabolism. The 1992 recipient: Marc Eric Leimbach.

Washington University School of Medicine Academic Achievement Award. Given annually to a student who has exhibited to an unusual degree the qualities of industry, perseverance, determination, and enthusiasm in the first-year academic program. The 1992 recipient: Adrienne Hortense Suggs.

Samson F. Wennerman Prize. Donated by his wife, Zelda E. Wennerman, and awarded annually to that fourth-year student who has demonstrated promise in surgery. The 1992 recipient: Jonathan Andrew Morris.


Lectureships and Visiting Professorships

Several established lectureships enable the School to bring to the Medical Center each year distinguished guests who contribute significantly to the richness of student life.

Ben T. Abelson Memorial Lectureship in Pediatric Hematology-Oncology. Established by Mrs. Ben T. (Ann) Abelson, the first lecture was held on January 8, 1988.

Harry Alexander Visiting Professorship. Established in 1964 by former house officers and friends of Dr. Harry Alexander to provide an annual visiting professor in the Department of Medicine.

Alpha Omega Alpha Lectureship. Given each year by a faculty member of the students’ selection.

Daniel R. Biello Memorial Lectureship. Established in 1986 by friends, students and colleagues of Dr. Daniel R. Biello to provide an annual lectureship devoted to advances in radiology and nuclear medicine.

George H. Bishop Lectureship. Supported by funds made available by friends interested in the advancement of neurology.

Estelle Brodman Lectureship Fund. Established in 1938 by friends and colleagues of Dr. Brodman in honor of her distinguished contributions to the School of Medicine.

The James Barrett Brown Visiting Professorship in Plastic and Reconstructive Surgery. Created in 1969 by patients, friends, colleagues, and former students to honor Dr. Brown.

Philip R. Dodge Lectureship. Established in 1987 by friends and colleagues to provide an annual lectureship in the Department of Pediatrics.

Joseph Erlanger Lectureship. Established in 1989 by the Department of Cell Biology and Physiology to honor Dr. Erlanger.

Jeronimo Fiance Visiting Professorship. Established in 1977 by former students and friends of Dr. Flance to provide an annually visiting professor in the Division of Pulmonary Diseases.

Julia Hudson Freund Lectureship. Established in 1982 by S. E. Freund in memory of his wife to provide a visiting lectureship in clinical oncology.

Edwin F. Gildea, Jr. Lectureship in Psychiatry. Established in 1978 by friends, colleagues, and former students of Dr. Gildea.

Joseph J. Gitt Visiting Professorship in Clinical Neurology. Established in 1971 by his family and friends to honor Dr. Gitt.

Graham Colloquium. A gift from Mr. and Mrs. Evans Graham, Jr., in 1963 to encourage opportunities for students to expand their views on social, philosophical, artistic, and political topics.

The Evarts A. Graham Lecture. Established in 1985 by the Washington University Alumni of the Phi Beta Pi medical fraternity to honor the memory of Dr. Evans A. Graham.

Evarts A. Graham Memorial Lectureship. Established in 1959 with a reserve fund left by Dr. Graham for his successors.

Evarts A. Graham Visiting Professorship of Surgery. Established in 1968 by The Harry Freund Memorial Foundation to support an annual lecture in honor of Dr. Graham’s contributions to surgery.

Samuel B. Grant Visiting Professorship. Created in 1977 by former students and friends of Dr. Fiance to provide annually a visiting professor in the Department of Medicine.

Samuel B. Guze Lectureship. Established in 1991 by the Kidney Foundation to honor Dr. Klahr, past president of the National Kidney Foundation, and the John E. and Adaline Simon Professor and Vice Chairman of the Department of Medicine at Washington University.

Rose and Samuel Pollock Surgical Lectureship. Established in 1976 by Dr. Joseph H. Pollock in memory of his parents.

The Probstein Oncology Lectureship. Established in 1985 by Mr. and Mrs. Norman K. Probstein in appreciation of professional services provided by William Fair, M.D., former head of the urology division of the Department of Surgery, and Carlos Perez, M.D., professor of radiology and head of radiation oncology at the Medical Center’s Mallinckrodt Institute of Radiology.

El Robins Lectureship in Psychiatry. Established in 1977 by friends, colleagues, and former students of Dr. Robins.

St. Louis Football Cardinals Visiting Professorship in Orthopedic Surgery. Made possible since 1971 by donations from the St. Louis Football Cardinals.

Henry G. Schwartz Lectureship. Created in 1983 by former residents and colleagues from the neurosurgery department to honor Dr. Schwartz.


Paul E. Lacy Lectureship in Pathology. Established in 1987 by The Kilo Diabetes and Vascular Research Foundation in honor of Dr. Lacy’s many contributions to pathology and diabetes research, and to recognize his collaboration over the years with the co-founders of The Kilo Foundation.

Irwin Levy Memorial Fund. Supports the Dr. Irwin Levy Visiting Lectureship in Neurology, which was established in 1978 by Mr. and Mrs. Meyer Kopelow.

Oliver H. Lowry Lectureship. Established in 1978 by friends, colleagues, and former students of Dr. Lowry.

H. Relton McCarroll, Sr., Visiting Professorship in Orthopedic Surgery. Created in 1972 by patients, friends, colleagues, and former students in honor of Dr. McCarroll.


Carl A. Moyer Visiting Professorship of Surgery. Established in 1978 by The Harry Freund Memorial Foundation to support an annual lecture in honor of Dr. Moyer’s contribution to surgery.

Joseph H. Ogura Lectureship. Established in 1977 by friends and colleagues of Dr. Ogura as a tribute to his numerous scientific accomplishments and contributions to the School of Medicine, graduate medical education, and commitment to patient care.

National Kidney Foundation—Saul Kahr, M.D., Lectureship. Established in 1991 by the Kidney Foundation to honor Dr. Klahr, past president of the National Kidney Foundation, and the John E. and Adaline Simon Professor and Vice Chairman of the Department of Medicine at Washington University.

Rose and Samuel Pollock Surgical Lectureship. Established in 1976 by Dr. Joseph H. Pollock in memory of his parents.
Wendell G. Scott Memorial Lectureship. Established in 1972 by friends and colleagues of Dr. Wendell G. Scott.

Major G. Seelig Lectureship. Established in 1948 in the field of surgery by friends of Dr. and Mrs. Seelig.

Philip A. Shaffer Lectureship. Founded in 1957 by friends of Dr. Shaffer in recognition of his accomplishments in biochemistry.

Frank O. Shobe Lectureship. Established in 1986 by friends of Dr. Shobe to honor him as a physician and teacher.

Eduardo Slatopolsky Lectureship. Established in 1988 by Mr. and Mrs. William Wolff in honor of Dr. Slatopolsky's 25-year association with the School.

C. R. Stephen, M.D., F.F.A.R.C.S. Fund for Lecture and Clinical Research in Anesthesiology. Established in 1986 by former students, residents, faculty and friends in honor of Dr. Stephen, first Head of the Department of Anesthesiology.

Sterling Drug Visiting Professorship in Pharmacology. Established in 1986 to honor Ernst Zander, M.D., former medical director of Sterling Drug, Inc.

The Donald B. Strominger Visiting Professorship. Established in 1984 by family, friends, and colleagues, fellows, and patients of Dr. Strominger in honor and in memory of his dedication and contributions to their lives, their careers, and to the field of medicine in pediatrics.

The Richard A. and Betty H. Sutter Visiting Professorship in Occupational and Industrial Medicine. Established in 1985 by Dr. and Mrs. Sutter to encourage opportunities for students, faculty, other physicians, and the St. Louis community to expand the understanding and practice of Occupational Medicine.

Jessie L. Ternberg Pediatric Surgery Visiting Lectureship. Made possible from a fund established in 1977 by Mr. Meyer Kopolow to honor Dr. Ternberg.

Robert J. Terry Lectureship (1939) and Visiting Professorship (1982). Established by alumni and Charles S. Terry, his son, respectively, “for the purpose of fostering greater appreciation of the study of anatomy.”

Mildred Trotter Lectureship. Established in 1975 by friends and former students of Mildred Trotter to bring a distinguished woman scientist to the School of Medicine each year.

Rudolph A. Tuteur Pulmonary Lectureship. This lectureship is endowed by family, friends, patients, and colleagues of the Tuteur family to memorialize Rudolph A. Tuteur. The goal of this annual fall event is to promote further understanding of problems associated with chronic pulmonary disease from which he suffered.
THE WASHINGTON UNIVERSITY GRADUATE

Residency Training

Although not required by all states for licensure, postgraduate residency training in an approved hospital is considered essential preparation for the practice of medicine. Most Washington University graduates serve three or more years of residency training, and some will gain additional experience as postdoctoral fellows.

In order to aid students in obtaining desirable residency appointments, an active counseling program is maintained by the Associate Dean for Student Affairs and the Associate Dean for Postgraduate Education. Thus, students in the Third Year Class are provided with general background information about the kinds of residencies available, special problems concerning certain extremely competitive residencies, and help in identifying faculty members for further assistance. Since the number of available residencies has recently decreased to approximately the same as that of graduates applying, students must make their choices with considerable care.

The Associate Dean for Postgraduate Education maintains an open file of brochures and other descriptive data regarding residencies throughout the country. Included are evaluations of the residency experience of our recent graduates. The School participates in the National Resident Matching Program, which offers distinct advantages to applicants.

Results of these efforts have been gratifying. The PGY-1 residencies selected in the most recent residency matching (1992) are identified in the Register of Students beginning on page 200. The School maintains an active interest in its graduates and is pleased to assist them in subsequent years as they seek more advanced training or staff appointments in the communities in which they settle.

Postdoctoral Training

Those departments which offer Postdoctoral Fellowships individualize such educational activity up to a maximum of 36 months of academic time. Such fellowships lead integrally to certification by the appropriate specialty and/or subspecialty boards of the American Medical Association.

Fellowship And Other Funds

Alexander and Gertrude Berg Fellowship Fund. Created in 1952 through the bequest of Gertrude Berg to provide a fellowship in the Department of Molecular Microbiology.


William H. Danforth Loan Fund for Interns and Residents in Surgery. Provides financial assistance in the form of loans for postdoctoral students in surgery.

Antonio Hernandez, Jr. Fellowship in Pediatric Cardiology. Established in 1987 as a memorial to Dr. Hernandez.

J. Albert Key Fellowship Fund. Provides a stipend for a fellow in orthopedic surgery.

Louis and Dorothy Koreitz Fellowship Fund. Established in 1970 by an alumnus and his wife to provide support for research by qualified residents or students interested in surgery, at the discretion of the Head of the Department of Surgery.

Stephen I. Morse Fellowship. Established in 1980 by Carl and Belle Morse in memory of their son; awarded to predoctoral or postdoctoral students pursuing research careers in microbiology, immunology, and infectious diseases.

The Esther and Morton Wohlgemuth Foundation Fellowship. Established to support a fellow in the Division of Cardiovascular Diseases.

Continuing Medical Education

The study of medicine is a lifelong process with continuing medical education being an integral part of the continuum. Since 1973 the School of Medicine has formally met its obligations to this learning endeavor through the operation of the Office of Continuing Medical Education. The objectives of this program are:

1. To provide high quality educational activities for alumni of Washington University School of Medicine and other physicians regionally and, on occasion, nationally.

2. To encourage lifelong learning by a variety of educational methods appropriate to the learners' needs.

3. To provide for the acquisition of new knowledge and skills and to aid in acquiring efficient problem-solving techniques for ultimate improvement in patient care.

4. To provide a forum where academic and practicing physicians can jointly explore solutions to health problems.

5. To translate the results of research and the habits of critical assessment of new data to the needs of practicing physicians.

Each year 50 to 60 symposia and approximately 100 academic rounds and conferences on a wide variety of topics are accredited by this office. About 4,000 registrants attend these courses annually and receive more than 600 hours of instruction. The educational program is fully accredited by the Accreditation Council for Continuing Medical Education and provides credits to physicians seeking them for the Physician's Recognition Award of the American Medical Association, as well as various other types of state and specialty recertification and relicensure activities.
The Washington University Medical Center Alumni Association (WUMCAA) was organized more than 55 years ago to foster a continuing spirit of fellowship among graduates, and to maintain and enhance the quality and standing of the School of Medicine. Membership is provided to graduates and former house officers of the Medical Center.

In order to complement the goals and purposes of the School of Medicine, the Association sponsors a variety of programs for its members and current students. Involvement provides the opportunity to develop and to continue rewarding professional associations and relationships.

**Student-Alumni Programs:** Many students and residents meet alumni on an informal basis during the admissions process. Alumni can be helpful sources of information about many aspects of the School's programs. Entering students are welcomed to the School annually through a program sponsored by the Alumni Association. The WUMCAA also provides an activity fund for both the First and Second Year Classes which is used for a variety of projects and purposes.

To further alumni-student relationships, the Association participates in a visitation program, designed to give medical students the opportunity to spend time on the job with a practicing physician. The Association also supports a variety of student-initiated community service activities, such as a drug education project and a summer program in biomedical research for St. Louis high school students.

The Academic Societies also benefit from support by WUMCAA. These provide opportunities for faculty and student interaction in a collegial environment.

**Reunions and Other Events:** The Annual Reunion is held in May and features special events for those celebrating their 5-year class reunions. It includes a scientific program, recognition ceremonies, and social events. Alumni Achievement, Alumni/Faculty, and Distinguished Service awards are presented at this time. Those selected to receive awards are chosen on the basis of personal accomplishment, professional achievement, and/or service to the School of Medicine. Members of the graduating class are also honored at this event.

Receptions for members are held at many national medical specialty meetings and include the introduction of Medical Center faculty and distinguished guests.

The Alumni Office sponsors special alumni activities in selected cities across the United States. This program allows alumni to stay abreast of educational and research activities at the School of Medicine. Volunteers from each area assist in sponsoring these activities.

**Alumni Support:** Contributing generous financial support to their school is a way of life for a high proportion of alumni of the medical school and the allied health programs. Alumni gifts to the Annual Fund support the School's departments and divisions and its allied health programs. They also strengthen, through giving to the Annual Fund, scholarship aid and low-interest loan programs for students. Alumni also make gifts for special purposes within the School, including specific research and education and training programs.

Developing additional sources of student financial aid is of great importance to the Alumni Association. Members have established the Distinguished Alumni Scholarship program to provide full-tuition, four-year scholarships to promising medical students in honor of great teachers and mentors, who were also alumni of the School of Medicine. Alumni and friends are solicited for gifts to this program each year through the Annual Fund.

In 1977, School of Medicine members of the Eliot Society created the Alumni Endowed Professorship program. These gifts will eventually establish an Alumni Endowed Chair in each of the School's departments. Four such chairs have already been created in Pathology, Molecular Microbiology, Pediatrics, and Molecular Biology and Pharmacology. Eliot Society members and other alumni are solicited for gifts to this effort each year through the Annual Fund.
ANATOMY AND NEUROBIOLOGY

The structure of the human body is presented in two courses: gross anatomy, offered in the first semester, and microscopic anatomy, offered in the second semester. A third course, neuroscience, is taught in the second semester. Gross anatomy is largely a laboratory course, with lectures dealing with anatomical principles and with human growth and development. The course in microscopic anatomy focuses on cell and tissue biology, with laboratory sessions paralleling the lectures in these areas. This course is closely coordinated with the Physiology course offered concurrently by the Department of Cell Biology and Physiology. Neural science is taught mainly from a problem solving point of view, with particular emphasis upon the structure and function of nerve cells and synapses and on the organization of the principal neural systems. Throughout all three courses attention is paid to the results of recent investigations and to major developments in each field. In addition, the department offers many graduate courses which may be taken as electives by students in any of the four years. The department is well equipped for special work in several areas, including gross anatomy, electron microscopy, tissue culture, and all aspects of neurobiology.

FIRST YEAR

Bio 501. Human Anatomy
The course is based largely on the dissection of the human body. Lectures on functional and topographic anatomy emphasize the principles of organization of the various systems of the body. Lectures on developmental anatomy stress organogenesis as an adjunct to understanding the normal and abnormal anatomy. An extensive museum of labeled dissected specimens is housed in the dissecting room for ready reference by students who encounter abnormalities or variations in their dissections. Frequent use of CT and MRI scans, radiographs, and cross sections aid in the synthesis of knowledge gained through dissection into clinically useful information. Radiologic anatomy and clinical correlation conferences further aid in this process. Credit 6 units.

Bio 506. Microscopic Anatomy
The structure of cells, tissues, and organs is studied with regard to the functional significance of the morphological features. The laboratories consist of the study of prepared slides, of preparations of fresh tissues, and of electron micrographs. A microscope will be provided for each student. Credit 4 units.

Bio 554. Neural Sciences
This course provides a broad introduction to modern neuroscience, including the structure, function and molecular biology of neurons, and a comprehensive overview of major systems in the central nervous system. Material is presented in lectures, small group conferences and laboratories. A wide range of electives (6-10 hours total) provide opportunities for in-depth study of particular areas (e.g., Learning and Plasticity in the Brain; Diseases of Ion Channels; Peptide Hormones in the Brain). Credit 5 units.

RESEARCH

Bio 590. Research Opportunities
These are offered in the following areas:
- Regulation of receptors for multi-purpose neuromodulators. Dr. Baenziger
- Growth and differentiation of muscle. Dr. Bischoff
- Cell biology of developing nerve and muscle cells. Dr. Bridgman
- Anatomy and physiology of the somatosensory cortex. Dr. Burton
- Evolutionary quantitative genetics and morphology. Dr. Cheverud
- Comparative primate anatomy and human evolution. Dr. Conroy
- Mechanisms of gene expression in developing and adult CNS. Dr. Gottlieb
- Molecular biology and functions of peptide-secreting and peptide-receptive neurons. Dr. Kruse
- Development of synaptic connections. Dr. Lichtman
- Viruses as tools to study CNS autonomic pathways; central regulation of blood pressure and cardiac function. Dr. Loewy
- The structure and function of the skin. Dr. Menton
- Molecular biology of dopaminergic synapses. Dr. O'Malley
- Behavior, morphology and biology of living primate populations. Dr. Phillips-Conroy
- The organization of the limbic forebrain, and its involvement in seizures and in Alzheimer's Disease. Dr. Price
- Molecular, genetic and physiological analysis of nerve and muscle membrane ion channels. Dr. Salkoff
- Molecular bases of synaptogenesis and retrovirus-mediated gene transfer to neural cells. Dr. Sanes
- Molecular and genetic studies of neuropeptides. Dr. Taghert
- Cellular neurophysiology of posture and movement control. Dr. Thach
Organization and function of visual cortex in primates. Dr. Van Essen
Axonal transport, cytoskeleton structure, and nerve regeneration. Dr. Willard

ELECTIVES
The department offers a number of graduate-level courses which may be taken as electives by medical students. The department participates in the Division of Biology and Biomedical Sciences, which also offers courses relevant to anatomy and neurobiology.

Faculty
Edison Professor of Neurobiology and Head of Department
David C. Van Essen, Ph.D., Harvard University, 1971.

Professors Emeriti
Roy R. Peterson, Ph.D., University of Kansas, 1952. (And Lecturer.)

Professors
Harold Burton, Ph.D., University of Wisconsin, 1968. (See Department of Cell Biology and Physiology.)
James M. Cheverud, Ph.D., University of Wisconsin, 1979. (See Department of Genetics.)
Theodore J. Cicero, Ph.D., Purdue University, 1968. (See Department of Psychiatry.)
Adolph I. Cohen, Ph.D., Columbia University, 1954. (See Department of Ophthalmology and Visual Sciences.)
Glenn C. Conroy, Ph.D., Yale University, 1974. (Also Faculty of Arts and Sciences)
David L. Gottlieb, Ph.D., Washington University, 1971. (See Department of Biochemistry and Molecular Biophysics.)
Stephen M. Highstein, M.D., University of Maryland Medical School, 1965; Ph.D., University of Tokyo, 1976. (See Department of Otolaryngology.)
Jeff W. Lichtman, M.D., Ph.D., Washington University, 1980.
Arthur D. Loewy, Ph.D., University of Wisconsin, 1969.
Joseph L. Price, Ph.D., Oxford University, 1969.
Joshua R. Sanes, Ph.D., Harvard University, 1976.
W. Thomas Thach, Jr., M.D., Harvard University, 1964. (See Department of Neurology and Neurological Surgery and Rehabilitation.)

Bio 5404. Molecular Neurobiology
Bio 5562. Neural Development
Bio 5571. Cellular Neurobiology
Bio 5651. Neural Systems
Bio 567. Advanced Tutorials in Neural Science

Note—The number preceding the course title indicates that the course is offered by the Division of Biology and Biomedical Sciences and carries credit in the Graduate School of Arts and Sciences.
Mark B. Willard, Ph.D., University of Wisconsin, 1971. (See Department of Biochemistry and Molecular Biophysics.)

Thomas A. Woolsey, M.D., The Johns Hopkins University, 1969. (See Departments of Neurology and Neurological Surgery and Cell Biology and Physiology.)

Associate Professors


Paul C. Bridgman, Ph.D., Purdue University, 1980.

Ursula W. Goodenough, Ph.D., Harvard University, 1969. (Also Faculty of Arts and Sciences)

James E. Krause, Ph.D., University of Wisconsin, Madison, 1980.

Christopher J. Lingle, Ph.D., University of Oregon, 1979. (See Department of Anesthesiology.)

David N. Menton, Ph.D., Brown University, 1966.

Karen L. O'Malley, Ph.D., University of Texas, Austin, 1980.

Steven E. Petersen (Neuropsychology), Ph.D., California Institute of Technology, 1981. (See Department of Neurology and Neurological Surgery.)

Jane Phillips-Conroy, Ph.D., New York University, 1978. (Also Faculty of Arts and Sciences)

Steven M. Rothman, M.D., State University of New York, Upstate, 1973. (See Departments of Pediatrics and Neurology and Neurological Surgery.)

Lawrence B. Salkoff, Ph.D., University of California, Berkeley, 1979. (See Department of Genetics.)

Joseph H. Steinbach, Ph.D., University of California, San Diego, 1973. (See Department of Anesthesiology.)

Paul H. Taghert, Ph.D., University of Washington, 1981.

Robert H. Waterston, M.D., The University of Chicago, 1972; Ph.D., 1972. (See Department of Genetics.)

Charles F. Zorumski, M.D., St. Louis University, 1978. (See Departments of Neurology and Neurological Surgery and Psychiatry.)

Research Associate Professor

Nancy L. Baenziger, Ph.D., Washington University, 1971.

Assistant Professors

Christine Blazynski, Ph.D., Purdue University, 1981. (See Department of Biochemistry and Molecular Biophysics and Department of Ophthalmology and Visual Sciences.)

Andreas H. Burkhalter, Ph.D., Brain Research Institute, University of Zurich, 1977. (See Department of Neurology and Neurological Surgery.)

Peter D. Lukasiewicz, Ph.D., University of Michigan, 1984. (See Department of Ophthalmology and Visual Sciences.)

Bruce L. Nock, Ph.D., Rutgers University, 1980. (See Department of Psychiatry.)

Keith M. Rich, M.D., Indiana University, 1977. (See Department of Neurology and Neurological Surgery.)

Marc H. Schieber, M.D., Ph.D., Washington University, 1982. (See Department of Neurology and Neurological Surgery.)

Lawrence Tychsen, M.D., Georgetown University, 1979. (See Department of Ophthalmology and Visual Sciences.)

Research Assistant Professor

Martin S. Silverman, Ph.D., University of California, San Francisco, 1984. (Also Faculty of Arts and Sciences)
ANESTHESIOLOGY

According to the American Board of Anesthesiology, this specialty may be described as a practice of medicine which encompasses: (1) the assessment of, consultation for, and preparation of patients for anesthesia; (2) the provision of insensibility to pain during surgical, obstetric, therapeutic and diagnostic procedures, and the management of patients so affected; (3) the monitoring and restoration of homeostasis during the perioperative period, as well as homeostasis in the critically ill, injured, or otherwise seriously ill patient; (4) the diagnosis and treatment of painful syndromes; (5) the clinical management and teaching of cardiac and pulmonary resuscitation; (6) the evaluation of respiratory function and application of respiratory therapy in all its forms; (7) the supervision, teaching and evaluation of performance of both medical and paramedical personnel involved in anesthesia, respiratory and critical care; (8) the conduct of research at the clinical and basic science levels to explain and improve the care of patients insofar as physiologic function and the response to drugs are concerned; and (9) the administrative involvement in hospitals, medical schools and outpatient facilities necessary to implement these responsibilities.

With these objectives in mind, this department is dedicated to presenting to the student, as opportunities develop: (1) clinical applications of certain anatomic relationships, e.g., regional nerve blocks; (2) applications of principles of respiratory physiology, e.g., mechanics of ventilation under various circumstances, cardiorespiratory resuscitation; (3) applications of pharmacologic knowledge related to sedative, narcotic, and anesthetic drugs, and to compounds affecting the autonomic nervous system; (4) clinical problems related to acid-base, fluid, and electrolyte balance in surgical patients; and (5) principles underlying the approaches to the concept of "critical care medicine."

Anesthesiology bridges the gap between basic science and clinical medicine. It can provide experience in the clinical evaluation of patients and in applied physiology and pharmacology in the acute setting, both in the critical care units, as well as the operating rooms. The clinical instruction in the operating room provides an exposure to the clinical practice of anesthesiology. During anesthesia electives, students are expected to participate in patient management in the intensive care area and/or operating rooms as the elective dictates.

Operating room anesthesiology clerkships are offered for two, four or six week periods. The pharmacology of inhalation, intravenous and local anesthetic drugs, as well as sedatives and narcotics, is demonstrated by practical application in the operating room. The importance of blood gas determinations and interpretations in evaluating the efficacy of ventilation is illustrated. Opportunities to provide proficiency in techniques, such as endotracheal intubation, central venous cannulation, and insertion of arterial catheters are available. Students are expected to attend the regular anesthesia conference and seminars. Actual amount of experience is determined primarily by the length of the elective.

A clerkship in clinical research allows the student to participate in the very active program of ongoing clinical research projects involving new anesthetic, sedative, and analgesic drugs. The student will be expected to participate in the design, data collection, and analysis. Prior approval is mandatory prior to admission to this course.

A four-week elective is also offered in critical care medicine that is designed to familiarize the student with the diagnosis and treatment of the critically-ill surgical patient. This is accomplished by the student becoming an integral part of the intensive care team.

Special electives in basic science research, as it applies to anesthesiology, can be arranged with the principal investigators in the Anesthesiology Research Unit under the direction of Joe Henry Steinbach, Ph.D. These research laboratories have various specific interests but the unit, as a whole, has emphasis on molecular neurobiology. Arrangements for these special electives are made through the specific investigators: Walter A. Boyle III, M.D.; Alex S. Evers, M.D.; Narasimhan Gautam, Ph.D.; Richard Hotchkiss, M.D.; Christopher Lingle, Ph.D.; or Joe Henry Steinbach, Ph.D.
Faculty

Acting Head of Department
Alex S. Evers, M.D., New York University, 1978. (See Departments of Medicine and Molecular Biology and Pharmacology.)

Professors Emeriti
Albert Roos, M.D., University of Groningen, 1940. (See Department of Cell Biology and Physiology.)
C. R. Stephen, M.D.C.M., McGill University, 1940.

Professors
Leonard W. Fabian, M.D., University of Arkansas, 1951.
Demetrios G. Lappas, M.D., Aristotelian University, Thessaloniki, Greece, 1961; Ph.D., 1966.

Professor (Clinical)
Bernard C. DeLeo, M.D., St. Louis University, 1958.

Associate Professor Emeritus

Associate Professors
Christopher J. Lingle, Ph.D., University of Oregon, 1979. (See Department of Anatomy and Neurobiology.)
Necita L. Roa, M.D., University of the Philippines, 1969.
Joseph H. Steinbach, Ph.D., University of California, San Diego, 1973. (See Department of Anatomy and Neurobiology.)
Rene Tempelhoff, M.D., University of Lyon, France, 1984.
Lewis J. Thomas, Jr., M.D., Washington University, 1957. (See Department of Cell Biology and Physiology and Institute for Biomedical Computing.)

Associate Professor (Clinical)
Milton L. Cobb, M.D., University of Texas (Southwestern), 1968.

Assistant Professors
Robert Feinstein, Ph.D., University of Michigan, 1968; M.D., Texas A & M University, 1982.
Joel B. Gunter, M.D., University of Oklahoma, 1982. (See Department of Pediatrics.)
Melvin Haber, M.D., New York University, 1963. (See Department of Ophthalmology and Visual Sciences.)
Paul M. Heerdt, M.D., University of Tennessee, 1982; Ph.D., University of Tennessee Graduate School of Medical Sciences, 1985.
Barbel Holtmann, M.D., University of Missouri, 1968.
Richard S. Hotchkiss, M.D., University of Virginia, 1976.
Terri G. Monk, M.D., University of Nebraska, 1977.
Carl H. Nielsen, M.D., Copenhagen Medical School, 1979.

Anastasios N. Triantafillou, M.D., University of Athens, Greece, 1970.
Mehernoor F. Watcha, M.B.B.S., Seth G.S. Medical College, 1972. (See Department of Pediatrics.)
Carey Ira Weiss, M.D., University of Illinois, Chicago, 1979.
Elizabeth Lynne Williams, M.B., B.S., University of Sydney (Australia), 1972.

Assistant Professors (Clinical)
Nabil Abboud, M.D., St. Joseph’s University, 1970. (Jewish Hospital)
Spomenko Bauer, M.D., University of Zagreb Faculty of Medicine, 1968. (Jewish Hospital)
W. Patrick Gibson, M.D., University of Arkansas, 1974.
Barry A. Graff, M.D., St. Louis University, 1976. (Jewish Hospital)
Gary E. Hirshberg, M.D., Hahnemann Medical College, 1972. (Shriners Hospital)
James J. Jenkins, M.D., University of North Carolina, 1970. (Jewish Hospital)
Lawrence S. Waldbaun, M.D., Washington University, 1973. (Jewish Hospital)
Assistant Professor (Research)

Narasimhan Gautam, Ph.D., University of Bombay, India, 1983.

Instructors

Matthew S. Bodner, M.D., Washington University, 1980.
Gerold N. Borodach, M.D., Tufts University, 1959.
Laila M. Bottros, M.D., Ain Shams University, Cairo, Egypt, 1978.
Julia Bustamante, M.D., University of Missouri, 1985.
Ursula Class, M.D., University of Tübingen, Germany, 1982.
Michael T. Connor, M.D., Wayne State University, 1974. (See Department of Pediatrics.)
George Despotis, M.D., St. Louis University, 1985.
Catherine M. Dunn, M.D., University of Missouri, 1982.
John C. Han, M.D., University of Illinois (Rockford), 1986.
Timothy J. Herbst, M.D., Washington University, 1981.
Charles W. Hogue, M.D., University of Illinois, Chicago, 1986.
Frances M. Houghton, M.D., University of Nebraska, 1974.
Garry A. Johnson, M.D., University of California, Davis, 1980.
Michael J. Leavell, M.D., University of Kansas, 1984.
Barry P. Markovitz, M.D., University of Pennsylvania, 1983. (See Department of Pediatrics)

Judy Massengill, M.D., St. Louis University, 1988.
Alice A. Otto, M.D., St. Louis University, 1977.
Charles G. Pond, M.D., St. Louis University, 1980.
Elaine V. Riegle, M.D., University of Iowa, 1967.
Hind Shabany-Bashiti, M.B.B.Ch., Ain Shams University, Cairo, Egypt, 1971.
James M. Shear, M.D., University of Missouri, 1981.
Robert A. Swarm, M.D., Washington University, 1983.
Raghu TerKonda, M.D., University of Missouri, 1987.
Steven A. Turner, M.D., Ohio State University, 1984.
Karen L. Weiss, M.D., Boston University, 1980.
B. Craig Weldon, M.D., St. Louis University, 1978. (See Department of Pediatrics.)
Patricia Young-Beyer, M.D., University of California, San Diego, 1981.

Dorothy S. Fryer, M.D., St. Louis University, 1977.
Robert B. Holloway, M.D., Meharry Medical College, 1956. (John Cochran Veterans Hospital)
Akira Iwane, M.D., Nihon University, Japan, 1966.
Mitchell R. Platin, M.D., Northwestern University, 1987. (Jewish Hospital)
Frank E. Robbins, M.D., Washington University, 1977. (Jewish Hospital)
Ellis R. Taylor, M.D., Washington University, 1980. (Jewish Hospital)
Silvestre A. Tomeldan, M.D., Far Eastern University, Manila, 1970. (Jewish Hospital)
Madhav Vinjamuri, M.B.B.S., Medical College of Gulbarga, India, 1971.
G. Ram Volotzky, M.D., Sackler School of Medicine, Tel Aviv (Israel), 1979. (Jewish Hospital)

Instructors (Clinical)

Jennifer W. Cole, M.D., Washington University, 1984. (Jewish Hospital)
Robert C. Engelhardt, M.D., University of Missouri, 1950.
DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOPHYSICS
The department offers an advanced course in biochemistry as well as several specialized courses in the major fields of biochemistry. Students of medicine or those in the Graduate School of Arts and Sciences may enroll in these courses or pursue research work under the direction of members of the faculty. The interests of the faculty, listed below, cover many aspects of biochemistry and biophysics with special emphasis on structure/function relationships in proteins, enzymology, metabolic regulation, molecular biology of gene expression and protein biosynthesis, lipid metabolism, and the dynamics of cytoskeletal proteins.

**FIRST YEAR**

**Bio 531. Advanced Biochemistry**
Designed primarily for medical students; study of major control systems of metabolic processes. The course begins with a treatment of protein structure and enzyme kinetics. Basic metabolic pathways are presented as a basis for the discussion of their regulation by hormone receptors and their signal transduction mechanisms and the role of kinases in metabolic regulation. Other topics include lipoproteins and the regulation of lipid metabolism, control of cellular proliferation and oncogenes. Coordinated with other first semester courses, Cell Biology and Molecular Genetics, to provide an integrated first semester curriculum in the basic sciences for medicine.

**RESEARCH**

**Bio 590. Research Opportunities**
These are offered in the following areas of biochemistry:

- Biophysical chemistry of proteins and nucleic acids. Regulatory interactions in macromolecular assemblies. Mutagenic analysis of structure-function relationships in human hemoglobins and gene control systems. Dr. Ackers
- Genetic engineering of plants to express useful genes; DNA sequence analysis. Dr. Barnes
- Studies of protein structure and function. Methods employed include x-ray diffraction and molecular modeling. Current research interests focus on proteins involved in blood coagulation and fibrinolysis, and on the structural determinants for protein stability. Dr. Birktoft
- Biochemical approaches for the study of signal transduction. Signal transduction and information processing in the retina. Retinal pharmacology and neurochemistry. Dr. Blazynski
- Molecular biology of yeast; control and fidelity of chromosomal DNA replication. Dr. Burgers
- Biophysical studies of protein-mediated lipid transport in normal and disease states; multidimensional NMR studies of lipid-protein complexes. Dr. Cistola
- Theoretical and experimental aspects of thermodynamic and kinetic coupling in biological macromolecules. Experimental studies of thrombin. Dr. Di Cera
- Physical studies of enzyme reaction mechanisms. Dr. Drysdale
- Interactions between cell surface and cytoskeleton. Mobility of molecules in animal cell surfaces. Forces and mechanisms which determine cell shape and cellular viscoelasticity. Dr. Elson
- Structure and function of macromolecules involved in cell-matrix interaction and growth regulation in vascular cells. Dr. Frazier
- Protein folding and protein-protein interactions. Actin polymerization and actin binding proteins. Enzyme kinetic theory and enzyme mechanisms. Dr. Frieden
- Structure and function of RNA molecules, studied by NMR spectroscopy, as well as chemical and biological probes. RNA-protein interactions. Dr. Hall
- Structure of the oligosaccharides of soluble and membrane glycoproteins and their interactions with lectins. Dr. Kornfeld
- Catalytic strategies of enzymes. Spectroscopic (NMR, FTIR, etc.) and kinetic studies of substrate, intermediate and transition state analog interactions with normal and mutant enzymes. Dr. Kurz
- Equilibria and kinetic mechanisms of protein-DNA interactions, particularly those involved in replication, such as helicases and helix destabilizing proteins; polyelectrolyte properties of nucleic acids and proteins. Dr. Lobman
- Transcriptional regulation of gene expression in retroviruses and yeast. Dr. Majors
- Mechanism of action of growth factors; phosphorylation of proteins on tyrosine, turnover of phosphatidylinositol. Dr. Pike
- Computational models of protein mechanics, dynamics and folding; experimental protein engineering and peptide design. Dr. Ponder
- Lipid mediated signal transduction; membrane lipid synthesis, assembly, organization and function in eukaryotes. Dr. Silbert
- Gene structure and protein biosynthesis in eukaryotes. Cloning, translation and compartmentalization of secretory, mitochondrial, and membrane protein. Dr. Strauss
ELECTIVES

Descriptions of the elective courses are listed under the Division of Biology and Biomedical Sciences. In some instances, these courses are offered in alternate years. The faculty member in charge of the course should be contacted for specific times.

Bio 5083. Principles of Protein Chemistry
Peptide synthesis, protein purification and sequencing, enzyme kinetics and allostery will be covered in the first half of the course. Subsequently, protein structure/function is examined through discussions of protein folding, site-directed mutagenesis studies and an introduction to the physical methods used to determine protein structure. Dr. Pike

Bio 538. Structure and Function of Cell Membranes and Surfaces
An advanced graduate course with in-depth treatment of current areas of research in membrane biochemistry and cell biology. Topics included are contemporary cell membrane models, membrane structure as revealed by physical and biological methods; physical properties of lipids and membrane proteins; permeability and active transport in mammalian and bacterial systems; cell recognition, membrane targeting receptors, and transduction systems. Drs. Frazier, Mueckler

Faculty

Wittcoff Professor and Head of Department

Professors Emeriti
Barbara I. Brown, Ph.D., Yale University, 1950.
David H. Brown, Ph.D., California Institute of Technology, 1948.

Associate Professor Emeritus
William F. Holmes, Ph.D., University of Pennsylvania, 1960. (See Biomedical Computer Laboratory.)

Professors
Jonathan B. Cohen, Ph.D., Harvard College, 1972. (See Department of Anatomy and Neurobiology.)
Thomas F. Deuel, M.D., Columbia University, 1961. (See Department of Medicine.)
George R. Drysdale, Ph.D., University of Wisconsin, 1952.
Sarah C. R. Elgin, Ph.D., California Institute of Technology, 1971. (Also Department of Biology)
Elliot I. Elson, Ph.D., Stanford University, 1966.
William A. Frazier III, Ph.D., Washington University, 1973. (See Department of Cell Biology and Physiology.)
Carl Frieden, Ph.D., University of Wisconsin, 1955.
Rosalind H. Kornfeld, Ph.D., Washington University, 1961. (See Department of Medicine.)
Stuart A. Kornfeld, M.D., Washington University, 1962. (See Department of Medicine.)
Timothy M. Lohman, Ph.D., University of Wisconsin, 1977.
Philip W. Majerus, M.D., Washington University, 1961. (See Department of Medicine.)
Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Pharmacology and Institute for Biomedical Computing.)
F. Scott Mathews, Ph.D., University of Minnesota, 1959. (See Department of Cell Biology and Physiology.)
Blake W. Moore, Ph.D., Northwestern University, 1952. (See Department of Psychiatry.)
William R. Sherman, Ph.D., University of Illinois, 1955. (See Department of Psychiatry.)
David F. Silbert, M.D., Harvard University, 1962.
Arnold W. Strauss, M.D., Washington University, 1970. (See Department of Pediatrics.)
Robert E. Thach, Ph.D., Harvard University, 1964. (Also Department of Biology)
James C. Warren, M.D., University of Kansas, 1954; Ph.D., University of Nebraska, 1961. (See Department of Obstetrics and Gynecology.)

Professors (Adjunct)
Carl D. Rhodes, Ph.D., The Johns Hopkins University, 1971. (See Department of Biology.)

Associate Professors
Wayne M. Barnes, Ph.D., University of Wisconsin, 1974.
Oscar P. Chilson, Ph.D., Florida State University, 1963. (Also Department of Biology)
Gregory J. Goldberg, Ph.D., Weizmann Institute of Science, 1977. (See Departments of Medicine and Molecular Microbiology.)
David I. Gottlieb, Ph.D., Washington University, 1971. (See Department of Anatomy and Neurobiology.)
John E. Majors, Ph.D., Harvard University, 1977.

Stephen M. Moerlein, Ph.D., Washington University, 1982. (See Department of Radiology.)

Linda J. Pike, Ph.D., Duke University, 1980.

Mark B. Willard, Ph.D., University of Wisconsin, 1971. (See Department of Anatomy and Neurobiology.)

Assistant Professors

Christine Blazynski, Ph.D., Purdue University, 1982. (See Departments of Anatomy and Neurobiology and Ophthalmology and Visual Sciences.)

David P. Cistola, Ph.D., M.D., Boston University School of Medicine, 1985.

Lucian Del Priore, M.D., University of Rochester, 1982; Ph.D., Cornell University, 1984. (See Department of Ophthalmology and Visual Sciences.)

Enrico Di Cera, M.D., Università Cattolica, Roma, Italy, 1985.

Steven M. Frisch, Ph.D., University of California, Berkeley, 1984. (See Department of Medicine.)

Kathleen B. Hall, Ph.D., University of California, Berkeley, 1984.

Robert C. Landick, Ph.D., University of Michigan, 1983. (Also Department of Biology)

Ellen Li, Ph.D., M.D., Washington University, 1980. (See Department of Medicine.)

Jay W. Ponder, Ph.D., Harvard University, 1984.

Katherine Parker Ponder, M.D., Washington University, 1983.

J. Evan Sadler, Ph.D., Duke University Medical Center, 1978; M.D., 1979. (See Department of Medicine.)

Douglas M. Tollefsen, Ph.D., M.D., Washington University, 1977. (See Department of Medicine.)

Research Assistant Professors


Research Instructors

Yingwen Huang, Ph.D., Southern Illinois University, 1991.

Dhandapani Kuppuswamy, Ph.D., University of Madras, Madras, India, 1984.


James J. Toner, Jr., Ph.D., St. Louis University, 1973.
DEPARTMENT OF
CELL BIOLOGY
AND
PHYSIOLOGY
CELL BIOLOGY AND PHYSIOLOGY

The department offers instruction to medical and graduate students. A Cell Biology course in the first semester of the medical curriculum deals with introductory cell biology, and cellular biophysics. This course is part of an integrated basic life sciences program offered in the first semester. A Physiology course in the second semester of the first year is designed to provide students with a foundation for their further study of clinical and applied physiology. The Department also offers a Neural Sciences course (jointly with the Department of Anatomy and Neurobiology) in the second semester. In addition, advanced courses open to medical and graduate students provide for more detailed study of specific areas of cell biology, physiology, and cellular biophysics.

The following research interests are represented in the Department at the present time: macromolecular structure as studied by x-ray crystallography and other physical methods, the mechanism of action of polypeptide hormones, transport across cell membranes, molecular biology of epithelial transport, reconstitution of intracellular transport including secretion and endocytosis, renal physiology, neurophysiology, contractile activation of muscle, peripheral circulation, respiration, and the application of computer techniques to biological problems. Electron microscopy of nerve and muscle is used to relate structure and function in these tissues.

FIRST YEAR

Bio 502. Physiology
This course integrates and extends the basic principles of cell biology and physiology to the functions of the major organ systems of the body, i.e., muscle, cardiovascular, renal, respiratory, gastrointestinal and endocrine. Credit 3 units.

Bio 5061. Cell Biology
A course covering fundamental aspects of cell organization and physiology. The goal is to develop an understanding of fundamental cellular processes such as transport, secretion, motility and recognition and to provide a working knowledge of transport across biological barriers, that are relevant to medical physiology. Credit 3 units.

RESEARCH

Bio 590. Research Opportunities
The department offers a variety of research opportunities, particularly in the following areas: macromolecular structure as studied by x-ray crystallography; synthesis and biological activities of polypeptides; reconstitution of membrane transport; lysosomes and intracellular transport; neurophysiology, including nerve membrane, muscle, synaptic transmission, sensory systems (especially auditory and visual), electron microscopy of neural tissues, and biochemical regulation in neurons; circulation; respiration; renal physiology; and the application of computer sciences to physiological problems.

Plasma markers of myocardial infarction and reperfusion; metabolism of creatine kinase isoenzymes; mechanisms of delayed thrombolysis and recurrent arterial thrombosis. Dr. Dana Abendschein

Control of cell-to-cell signaling and cellular proliferation by receptors, G proteins, and their effectors; yeast genetics, physiology, and biochemistry are the primary techniques. Dr. Kendall J. Blumer

The regulation of receptor-mediated ingestion by professional phagocytes. The mechanisms of signal transduction via a class of molecules known as integrins which act as receptors for extracellular matrix and potentially as organizers of cytoskeletal-membrane interaction in these cells. Dr. Eric J. Brown

Developmental regulation of complement biosynthesis in human mononuclear phagocytes. Molecular and cellular mechanisms which account for plasma protein deficiencies, role of mononuclear phagocytes in inflammation and organ development. Dr. F. Sessions Cole

The role of actin polymerization and actin-binding proteins in cell motility, using a variety of techniques in molecular and cell biology. Dr. John A. Cooper

Development of the visual system; effects of visual deprivation on this development; and the function of synaptic transmitters in the visual system. Dr. Nigel W. Daw

Cell and molecular biology of the mammalian vacuolar proton pump. Dr. Stephen L. Gluck

Development of new methods for visualizing cells and molecules in three dimensions by means of electron microscopy, and for capturing macromolecular mechanisms through rapid freezing techniques. Dr. John E. Heuser

Excitatory amino acid receptors and synaptic transmission in the central nervous system. Dr. James Huettner

Cell biology of insulin-stimulated glucose transport. Cloning and characterization of the major glucose transporter species of insulin-sensitive tissues. Using both site-directed mutagenesis and specific antibodies, studies are being conducted to understand how insulin modifies the transport rate and cellular location of this insulin-regulatable glucose transporter in the cell. Dr. David E. James

The suppression of calcium channel activity by opioid peptides in sensory neurons. Two key issues being addressed are: 1) the biochemical link between opioid receptors and Ca channels; 2) heterogeneity of the response of different sensory neuron subsets to opioid peptides. Dr. Edwin McCleskey
Studies of protein structure and function. Current research interest focuses on proteins involved in electron transfer interactions, and oxidation-reduction reactions. Methods employed include x-ray diffraction, molecular modeling and site-directed mutagenesis. Dr. F. Scott Matthews

Understanding the complex process of extracellular matrix assembly and organization, including studying the intracellular pathways used to transport matrix components to the cell surface and identifying helper or accessory proteins that facilitate trafficking and matrix assembly. Cell-matrix interactions in development and cellular mechanisms associated with connective tissue remodeling in vascular disease and heritable diseases of connective tissue. Dr. Robert Mecham


Patch clamp characterization of ion channels involved in stimulus secretion coupling in neurons and endocrine cells (e.g. ATP sensitive K⁺ channels, voltage-sensitive Ca²⁺ channels, stretch activated cation channels). Fluorescence imaging of cytosolic Ca²⁺ in these cells. Dr. Stanley Misler

Molecular biology of the mammalian glucose transporter. Gene structure, biosynthesis and regulation. Expression of transfected cDNA in foreign cells. Mechanism of insertion of proteins into the rough endoplasmic reticulum membrane. Dr. Mike Mueckler

Roles and regulation of ATP-sensitive K⁺ and other ion channels particularly in the heart. Cloning and expression of ion channels in vertebrate and invertebrate systems. Dr. Colin Nichols

Biosynthesis and packaging of peptide hormones investigated in cell lines in culture. Carboxypeptidase H, an exopeptidase important for production of mature hormone, is the current focus. Sorting of proteins to the regulated secretory pathway. Regulation of insulin biosynthesis in isolated human pancreatic islets. Neurochemical changes in the brain in Alzheimer's disease including studies of amyloid precursor protein, tau and GAP43. Dr. David Parkinson

Cell-cell and cell-substrate interactions in the early development of mammalian cerebral cortex. Tissue culture assays, light- and electron- microscopic immunohistochemistry, and time-lapse video recording are used to study the role of cell surface and extracellular matrix molecules in neuronal migration and axonal elongation. Dr. Alan L. Pearlman

Cellular biochemistry of genetic α, antitrypsin deficiency in which an abnormally folded protein accumulates in the endoplasmic reticulum and interacts with a heat shock protein; characterization of a cell surface receptor which recognizes α, antitrypsin-elastase complexes and activates a signal transduction pathway for regulation of α, antitrypsin gene expression; regulation of gene expression during the host response to inflammation. Dr. David Perlmutter
Transmembrane movements of H+ ions. Regulation of intracellular pH, using electrophysiological and optical methods. Dr. Albert Roos

Models for brain angiogenesis, blood flow and blood-brain barrier. Dr. Carl M. Rovainen

Molecular mechanisms and regulation of acidification and ion transport by intracellular vesicles. Dr. Paul Schlesinger

Study of the physiologic basis of human neutrophil function: the role of ion movements in the cellular responses to chemotactic factors and other stimuli. Dr. Louis Simchowitz

Receptor-mediated endocytosis and the reconstitution of vesicular transport in broken cell preparations. Regulation of receptor biosynthesis and deployment. Dr. Philip D. Stahl

Mechanism of receptor internalization and recycling. Physiologic role of receptors which recognize sugars or other ligands on proteins and on other cells. Dr. Philip D. Stahl

Computer-based acquisition and analysis of biological signals via digital signal processing techniques for quantitative biomedical imaging. Dr. Lewis J. Thomas, Jr

Physiology of skeletal muscle and nerve-muscle synapses, especially the role of innervation in determining muscle cell properties. Dr. Robert S. Wilkinson

ELECTIVES

Descriptions of the following courses may be found under the Division of Biology and Biomedical Sciences.

Bio 459. Vision
Bio 5062. Central Questions in Cell Biology
Bio 5063. Molecular Cell Biology
Bio 5111. Intracellular Transport of Macromolecules in Animal Cells
Bio 5132. Cell Motility and Cytoskeleton Journal Club
Bio 5134. Topics in Cell Motility and Cytoskeletal Function
Bio 559. Nerve, Muscle, and Synapse
Bio 567. Advanced Tutorials

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences. See course descriptions in the Graduate Training section of the catalog.

Faculty

Edward Mallinckrodt, Jr., Professor and Head of Department
Philip D. Stahl, Ph.D., West Virginia University, 1967.

Professors Emeriti

Hallowell Davis, M.D., Harvard University, 1922; Sc.D., (hon.), Colby College, 1954; Sc.D., (hon.), Northwestern University, 1962; Sc.D. (hon.), Washington University, 1973. (See Department of Otolaryngology.) (Also Lecturer) (Also Central Institute for the Deaf)

Carlton C. Hunt, M.D., Cornell University, 1942. (See Department of Neurology and Neurological Surgery.)

Stanley Lang, Ph.D., The University of Chicago, 1953.

Lecturer

Albert Roos, M.D., University of Groningen, 1940. (See Department of Anesthesiology.)

Professors

Jacques U. Baenziger, M.D., Ph.D., Washington University, 1975. (See Department of Pathology.)

Jerome R. Cox, Jr. (Biomedical Engineering), Sc.D., Massachusetts Institute of Technology, 1954. (See Biomedical Computer Laboratory) (Also School of Engineering and Applied Science)

Nigel W. Daw, Ph.D., The Johns Hopkins University, 1967. (See Departments of Anatomy and Neurobiology and Ophthalmology and Visual Sciences.)

William A. Frazier III, Ph.D., Washington University, 1973. (See Department of Biochemistry and Molecular Biophysics.)

John E. Heuser, M.D., Harvard University, 1969.
John A. McDonald, Ph.D., Rice University, 1970; M.D., Duke University, 1973. (See Internal Medicine.)

F. Scott Mathews, Ph.D., University of Minnesota, 1959. (See Department of Biochemistry and Molecular Biophysics.)

Robert P. Mecham, Ph.D., Boston University, 1976. (See Department of Medicine.)

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (Also Computer Systems Laboratory.)

Alan L. Pearlman, M.D., Washington University, 1961. (See Department of Neurology and Neurological Surgery.)

Carl M. Rovainen, Ph.D., Harvard University, 1967.

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (Also Computer Systems Laboratory.)

Robert P. Mecham, Ph.D., Boston University, 1976. (See Department of Medicine.)

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (Also Computer Systems Laboratory.)

Alan L. Pearlman, M.D., Washington University, 1961. (See Department of Neurology and Neurological Surgery.)

Carl M. Rovainen, Ph.D., Harvard University, 1967.

Thomas A. Woolsey, M.D., The Johns Hopkins University, 1969. (See Departments of Anatomy and Neurobiology and Neurology and Neurological Surgery.)

Research Professor

Una S. Ryan, Ph.D., Cambridge University, 1968. (See Departments of Medicine and Surgery.)

Associate Professors

Eric J. Brown, M.D., Harvard Medical School, 1975. (See Department of Medicine.)

Harold Burton, Ph.D., University of Wisconsin, 1968. (See Department of Anatomy and Neurobiology.)

F. Sessions Cole, M.D., Yale University School of Medicine, 1973. (See Department of Pediatrics.)

L Lee Hamm, M.D., University of Alabama, 1976. (See Department of Medicine.)

Marc R. Hammerman, M.D., Washington University School of Medicine, 1972. (See Department of Medicine.)

Jack R. Hessler, D.V.M., University of Missouri, Columbia, 1983; M.S., University of Florida, 1968. (See Division of Comparative Medicine.)

Keith A. Hruska, M.D., Creighton University, 1969. (See Department of Medicine.)

Stanley Misler, Ph.D., New York University 1977; M.D. 1978. (See Department of Medicine.)

Mike Max Mueckler, Ph.D., University of Wisconsin, Madison, 1982.

David H. Perlmutter, M.D., St. Louis University, 1978. (See Department of Pediatrics.)


Louis Simchowitz, M.D., New York University, 1970. (See Department of Medicine.)

Lewis J. Thomas, Jr., M.D., Washington University, 1957. (See Department of Anesthesiology and Biomedical Computer Laboratory.)

Research Associate Professor

Dana Abendschein, Ph.D., Purdue University, 1978. (See Department of Medicine.)

Assistant Professors

Stuart R. Adler, M.D., Ph.D., Duke University, 1982. (See Department of Medicine.)

Eric Beyer, Ph.D., University of California, San Diego, 1981; M.D., 1982. (See Department of Medicine.)

Kendall J. Blumer, Ph.D., Duke University, 1986.

John A. Cooper, M.D., The Johns Hopkins University, 1982; Ph.D., 1983.
Douglas C. Dean, Ph.D., Kansas University, 1984. (See Internal Medicine.)

Robert J. Fallon, M.D., Ph.D., Columbia University, N.Y., 1980. (See Pediatrics.)

Stephen L. Gluck, M.D., University of California, Los Angeles, 1977. (See Department of Medicine.)

David A. Harris, M.D., Ph.D., Columbia University, N.Y., 1983.


David E. James, Ph.D., University of New South Wales, 1985.

Edwin W. McCleskey, Ph.D., University of Washington, Seattle, 1983.

James G. McNally, Ph.D., The University of Chicago, 1983. (See Institute for Biomedical Computing.)

Robert W. Mercer, Ph.D., Syracuse University, 1980.


David Parkinson, Ph.D., Cambridge University, 1979.

Clay Semenkovitch, M.D., Washington University, 1981. (See Internal Medicine.)

Thomas H. Steinberg, M.D., New York University, 1978. (See Department of Medicine.)

Robert S. Wilkinson, Ph.D., University of Texas, Austin, 1974.

Research Assistant Professors
Douglas C. Dean, Ph.D., University of Kansas, 1981.

Dorothy Schafer, Ph.D., University of Michigan, 1983.

Instructors
William E. Dale, Ph.D., University of Missouri, 1986.
JAMES S.
McDONNELL
DEPARTMENT OF
GENETICS
GENETICS

The Department of Genetics is at the forefront in developing new methods for physical and genetic mapping of the human genome and for identifying and isolating genes that cause inherited disease or susceptibility to disease. The Department supports a broad program of preclinical and graduate instruction in genetics, with research opportunities ranging from established experimental organisms to humans, and from molecular genetics to population genetics. A significant portion of the first-year course in basic medical sciences is devoted to human and clinical genetics, and particularly to the impact of new genetic technologies on the practice of medicine.

Advanced training in clinical genetics and in genetic research is available from the faculty in the Department of Genetics and from geneticists with principal appointments in many other departments within the Medical School.

The Department of Genetics offers a broad range of training opportunities in virtually all major areas of modern genetics. Numbered among the faculty are world leaders in genetic mapping, new methods of DNA manipulation and cloning, developmental genetics, neurogenetics, immunogenetics, human genetics, and population and evolutionary genetics.

In addition to opportunities in human genetics, research opportunities with experimental organisms include genetic studies with the mouse, fruit flies, nematodes, yeast and bacteria.

Many advanced courses and seminars are offered that focus on such subjects as the genetics of inherited disease, gene expression, genetic mapping, molecular genetics, developmental genetics, microbial genetics, immunogenetics, and population and evolutionary genetics. Extraordinary opportunities for research training and experience are available in all of these areas and at all levels. The programs are tailored to meet the needs of medical students, graduate students, and both M.D. and Ph.D. postdoctoral students pursuing advanced training in biomedical research.

FIRST YEAR

Molecular Genetics

The course is divided into two halves. The first half focuses on the mechanisms of regulation of gene expression in eukaryotes. This includes discussions of the structure of DNA and its means of replication, the organization and packaging of eukaryotic genomes, chromatin structure and the nucleosome, the organization of polymerase II class genes, the processing of their primary transcripts, and the
molecular basis for transcriptional and translational regulation including the use of transgenic mice to study cell-specific gene regulation. The second half focuses on how these concepts can be applied to an understanding of medical genetics. Topics covered include principles of Mendelian genetics, the molecular basis for various inborn errors of metabolism — their diagnosis and prenatal screening, the genetics of cancer, and finally, current strategies for mapping and characterizing the human genome. Drs. Hansen, Gordon (Molecular Biology and Pharmacology), and Staff

RESEARCH

Bio 590. Research Opportunities
Molecular genetics, gene cloning, genome mapping. Dr. Maynard Olson (Genetics), Dr. Robert Waterston (Genetics), Dr. Daniel Hartl (Genetics), Dr. H. Mark Johnston (Genetics), Dr. Richard Wilson (Genetics), Dr. Douglas Berg (Molecular Microbiology), Dr. Garrett Brodeur (Pediatrics), Dr. Timothy Ley (Surgery), Dr. Peter Rotwein (Medicine), Dr. David Schlessinger (Molecular Microbiology), Dr. Richard Todd (Psychiatry), Dr. Eric Green (Pathology)

Human linkage studies. Dr. Helen Donis-Keller (Genetics), Dr. Daniela Gerhard (Genetics), Dr. Dabeeru C. Rao (Biostatistics), Dr. Theodore Reich (Psychiatry), Dr. Brian Suarez (Psychiatry)

Bio 548. Nucleic Acids and Protein Biosynthesis
Fundamental aspects of the structure, biosynthesis, and function of nucleic acids and the biosynthesis of proteins. Emphasis on mechanisms involved in the biosynthetic processes and the regulation thereof. Prerequisites: Bio 337, 449 or equivalent or permission of the instructor. Dr. Johnson

Bio 5491. Advanced Genetics
Fundamental aspects of organismal genetics with emphasis on experimental studies that have contributed to the molecular analysis of complex biological problems. Examples drawn from bacteria, yeast, nematodes, fruit flies and mammalian systems. Prerequisite, graduate standing, or permission of instructor. Drs. Schedl, Johnston and Staff

Bio 5011. Ethics and Research Science
Exploration of ethical issues research scientists confront on a daily basis. Topics will include: ethics and the genome initiative, student-mentor relationships, collaborators’ rights and responsibilities, social issues in science, scientists’ role in society, social responsibility and knowledge of misconduct, conflict of interest and confidentiality, and oversight role of institutions. Case study and scenario presentations will provide focus for discussions. Dr. Donis-Keller and Staff

Note — The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.

Faculty

Professor and Acting Head of Genetics
Robert H. Waterston, M.D., The University of Chicago, 1972; Ph.D., 1972. (See Department of Anatomy and Neurobiology.)

Professors
Douglas E. Berg, Ph.D., University of Washington, 1969. (See Department of Molecular Microbiology.)
James M. Cheverud, Ph.D., University of Wisconsin, 1979. (See Anatomy and Neurobiology.)
C. Robert Cloninger, M.D., Washington University, 1970; M.D. (hon.), Umea University Sweden, 1983. (See Department of Psychiatry.)

Susan E. Cullen, Ph.D., Albert Einstein College, 1971. (See Department of Molecular Microbiology.)
Helen Donis-Keller, Ph.D., Harvard University, 1979. (See Department of Psychiatry.)
Ted H. Hansen, Ph.D., University of Michigan, 1975.
Daniel L. Hartl, Ph.D., University of Wisconsin, 1968. (Also Faculty of Arts and Sciences)
George B. Johnson, Ph.D., Stanford University, 1972. (Also Faculty of Arts and Sciences)

R. Paul Levine, Ph.D., University of California, Los Angeles, 1951.

Dabeeru C. Rao, Ph.D., Indian Statistical Institute, 1971. (See Department of Psychiatry and Division of Biostatistics.)

Theodore Reich, M.D., McGill University, 1963. (See Department of Psychiatry.)

Stanley Sawyer, Ph.D., California Institute of Technology, 1964. (See Division of Biostatistics.) (Also Faculty of Arts and Sciences)

David Schlessinger, Ph.D., Harvard University, 1961. (See Departments of Medicine and Molecular Microbiology.)

Donald C. Shreffler, Ph.D., California Institute of Technology, 1962.

Alan R. Templeton, Ph.D., University of Michigan, 1972. (Also Faculty of Arts and Sciences)

Associate Professors

Garrett M. Brodeur, M.D., Washington University, 1975. (See Department of Pediatrics.)

James P. Crane, M.D., Indiana University, 1970. (See Departments of Obstetrics and Gynecology and Radiology.)

Andrew C. Heath, Ph.D., University of Oxford, 1983. (See Department of Psychiatry.)

H. Mark Johnston, Ph.D., University of California, Berkeley, 1980.

Dennis Y. Loh, M.D., Harvard University, 1977. (See Departments of Medicine and Molecular Microbiology.)

Barbara A. Schaal, Ph.D., Yale University, 1974. (Also Faculty of Arts and Sciences)

Brian K. Suarez, Ph.D., University of California, Los Angeles, 1974. (See Department of Psychiatry.)

Richard D. Todd, Ph.D., University of Texas, Dallas, 1977; M.D., University of Texas, San Antonio, 1981. (See Department of Psychiatry.)

Assistant Professors

David D. Chaplin, M.D., Ph.D., Washington University, 1980. (See Departments of Medicine and Molecular Microbiology.)


Berengere M. de Martinville, M.D., Lyon Medical School, France, 1973. (See Department of Pediatrics.)

S. Bruce Downton, B.M., B.S., University of New South Wales, 1980. (See Department of Pediatrics.)

Ian W. Duncan, Ph.D., University of Washington, 1978. (Also Faculty of Arts and Sciences)

Timothy P. Fleming, Ph.D., University of Missouri, 1985. (See Department of Ophthalmology.)

Daniela S. Gerhard, Ph.D., Cornell University, 1982. (See Department of Psychiatry.)

Philip P. Green, Ph.D., University of California, Berkeley, 1976.

Timothy J. Ley, M.D., Washington University, 1978. (See Department of Medicine.)

J. Mark Petrashek, Ph.D., University of Texas at Galveston, 1981. (See Department of Ophthalmology and Visual Sciences.)

Peter S. Rotwein, M.D., Albert Einstein College of Medicine, 1975. (See Department of Medicine.)

Lawrence B. Salkoff, Ph.D., University of California, Berkeley, 1979. (See Department of Anatomy and Neurobiology.)

Tim B. Schedl, Ph.D., University of Wisconsin, 1984.

Michael S. Watson, Ph.D., University of Alabama, 1981. (See Department of Pediatrics.)

Research Assistant Professors

Janet M. Connolly, Ph.D., George Washington University, 1979.

Terence Featherstone, Ph.D., University of Birmingham, England 1980.

Vera Hauptfeld, Ph.D., Charles University, 1968.

Richard K. Wilson, Ph.D., University of Oklahoma, Norman, 1986.

Adjunct Assistant Professor

Gregory F. Hollis, Ph.D., The Johns Hopkins University, 1980.

Instructors

Nancy G. Kravit, Ph.D., University of Connecticut, 1986.

Elena Lozovskaya, Ph.D., USSR Academy of Sciences, 1977.

Raymond D. Miller, Ph.D., University of California, 1977.
The general medicine teaching services of the department are located at Barnes Hospital, Jewish Hospital, and Veterans Hospital (John Cochran Division) under the following directors:

Barnes Hospital, Dr. Kipnis
House Staff Training Program, Drs. Clutter and Goodenberger (Interim Directors)

Jewish Hospital, Dr. Klahr
House Staff Training Program, Dr. Lefrak

Veterans Hospital, Dr. Chase

In addition, for the purposes of both teaching and research, the Department of Medicine is divided into specialty divisions at Barnes Hospital and Jewish Hospital under the following directors:

Bioorganic Chemistry and Molecular Pharmacology, Dr. Gross
Bone and Mineral Diseases, Dr. Avioli
Cardiovascular Diseases, Drs. Sobel, Lange
Dermatology, Drs. Eisen, Welgus
Endocrinology and Metabolism, Dr. Cryer, Schonfeld
Gastroenterology, Drs. Alpers, Stenson
Hematology, Drs. Majorus, S. Kornfeld
Immunology and Allergy Diseases, Dr. Lob
Infectious Diseases, Drs. Medoff, Brown, Little
Laboratory Medicine, Dr. Miletich
Medical Informatics, Dr. Frisse
Oncology, Dr. Deuel
Renal Diseases, Drs. Hammerman, Hruiska
Respiratory and Critical Care Division, Dr. Senior (Drs. Holtzman and Schuster, Interim Directors)
Rheumatology, Dr. Atkinson

Instruction in Medicine is provided during all four years of the medical curriculum, beginning with human genetics and an introductory course in the first year. Teaching in the second year has two main objectives: the correlation of the basic sciences with clinical aspects of disease and training in the technical methods of physical examination and laboratory diagnosis. By the beginning of the third year, the student is prepared for supervised clinical study of individual patients. A clinical clerkship of 12 weeks, divided into two six-week periods, is served by third-year students on one of the medical services supervised by the department. In the final year, students may elect a subinternship in general medicine or select any of a series of elective courses offered in the various medical subspecialties.

FIRST YEAR

Topics in Clinical Medicine

This interdepartmental course is highly coordinated with Medicine in Modern Society. Students select topics of interest for in-depth study initiated by discussions in a small-group seminar format. Instruction in the second year is designed to (1) prepare students for the transition from the preclinical sciences to the study of the sick patient at the bedside, (2) help them analyze the manifestations of disease in terms of the altered mechanisms responsible for these manifestations, and (3) introduce them to the techniques of examination which are used regularly on all clinical services with the beginning of the third-year clerkships. This instruction is at times undertaken jointly with members of other clinical departments, and is coordinated when practicable with subject matter presented by the Department of Pathology.

SECOND YEAR

Teaching by the Department of Medicine is designed to (1) prepare students for the transition from the preclinical sciences to the study of the sick patient at the bedside, (2) help them analyze the manifestations of disease in terms of the altered mechanisms responsible for these manifestations, and (3) introduce them to the techniques of examination which are used regularly on all clinical services with the beginning of the third-year clerkships. This instruction is at times undertaken jointly with members of other clinical departments, and is coordinated when practicable with subject matter presented by the Department of Pathology.
Pathophysiology

Selected topics in clinical medicine are discussed in detail to illustrate the application of biochemical, physiological, and anatomical information in the understanding of pathological states. Cardiovascular and renal, neurological, gastrointestinal, hematological, metabolic, nutritional, and developmental diseases are reviewed by an interdepartmental faculty. Emphasis is placed on the use of fundamental information in approaching clinical problems as a way of thinking in preparation for a lifetime of medicine, during which much new information will constantly be acquired. Department of Medicine Staff

Preparation for Clinical Medicine

PCM is a multidisciplinary, clinical data collection and problem solving course designed to prepare students for meaningful participation in third year clinical activities as a member of the health care team. Centrally coordinated, the clinical aspects of Human Sexuality, Psychiatry, Pediatrics, Surgery, Ophthalmology, Otalaryngology, Obstetrics, Gynecology, Radiology, Neurology, and Medical Sociology are integrated to aid the students' development of skills in the physician-patient relationships, clinical data collection and problem solving. A variety of instructional formats are used including lecture, demonstration, video tape, small group discussions, supervised peer examination (supervised sessions where students perform portions of the physical exam on each other), evaluation of clinical subjects simulating patient care situations, and computer assisted instruction as well as supervised interaction with patients in both the ambulatory and hospital setting. Data collection, data processing, and problem solving are the desired skills; a view that the patient is a social being interacting with illness, family, environment, and physician is the desired attitude.

Student assessment includes two written examinations, term paper, and evaluation by clinical subject of student's clinical interaction and data handling skills. During the 269 hours of instruction, the mean student-faculty ratio is less than 6:1. Dr. Tuteur and Staff

THIRD YEAR

General Medicine

Supervised study of patients on the medical nursing divisions of Barnes Hospital (both Blue and Red), Jewish Hospital, and St. Louis Veterans Administration Hospital. Students are assigned in rotation as clinical clerks to the patients admitted to these services. Teaching is provided by attending physicians, house officers, consultants, and at regularly scheduled conferences. Formal instruction will be given in medical therapeutics during the clerkship. Students serve for six weeks on two of the four services. Drs. Chase, Kipnis, Klahr and Staff

Clinical Pathological Conference

Abstracts of the clinical records of patients upon whom postmortem examinations have been performed are presented in advance to members of the Third and Fourth Year Classes and to members of the medical staff. At each conference the diagnosis is discussed in detail by the clinical staff before the anatomical findings are presented by the pathologists. Dr. Kipnis and Medical Staff; Dr. Kissane and Pathology Staff

FOURTH YEAR ELECTIVES

Medical Subinternship

Medical subinternships, in multiples of six weeks, are offered to a limited number of students on the following medical services: Barnes Hospital Blue and Red Services, Jewish Hospital and St. Louis Veterans Affairs Medical Center. Duties and responsibilities, including nights on call, will be those of an intern, with the proviso that requirements of Missouri state law must be met (e.g., orders must be countersigned by a licensed physician, etc.). The workload will be lighter than that for interns to insure ample time for reading about patients. Instruction and supervision will be provided by the appropriate chief of service, attending physicians, consultants, and house officers. Attendance at scheduled teaching conferences is required. The subinternship should be especially valuable to students who plan to take straight medical internships and to those who plan to go directly into a specialty residency program without first serving an internship of any kind (e.g., neurology, psychiatry, etc.). Drs. Chase, Kipnis, Klahr and Staff

Clinical Pathological Conference

Thursday, 12-1 p.m., September to June. Dr. Kipnis and Medical Staff, Dr. Kissane and Pathology Staff

Arthritic and Rheumatic Diseases

(A) Clinical Rheumatology. Barnes, Jewish, and VA, four weeks, all day. Students will participate in consultative service and clinic and inpatient practices. Laboratory experience also available. Dr. Atkinson and Staff

(B) Research.

1. Analysis of intracellular signaling events involved with human B cell proliferation and subpopulation selection induced by different cytokines. Dr. Ambrus

2. Studies related to complement deficiency states and immunogenetics of complement proteins in humans and animals; biochemical, and molecular biology of complement receptors and complement regulatory proteins. Dr. Atkinson
3. Projects are offered in analyzing the molecular structure and regulation of expression of the human and murine complement and Epstein-Barr virus receptors. Dr. Holers

4. Ongoing projects include analysis of the triggering mechanisms involved in lupus nephritis, investigations on the role of leukocytes in glomerular inflammation and dysfunction, and efforts to detail the role and regulation of lipid mediators in glomerular inflammation. Dr. Lefkowith

**Bioorganic Chemistry and Molecular Pharmacology**

Research Elective. Lipid mediators of signal transduction in the cardiovascular system. Characterization of regulatory mechanisms responsible for the liberation of lipid second messengers during cellular activation. Dr. Gross

**Cardiovascular Disease**

(A) Cardiology Consult Service - Jewish Hospital. Six Weeks. Students will receive intensive training in clinical electrocardiography and a broad exposure to consultative cardiology. Emphasis will also be placed on non-invasive techniques on evaluating cardiac disease. Drs. Rich, Kleiger, Krone and Staff

(B) Cardiac Catheterization and Hemodynamics. Highly specialized elective. Four weeks. Students will attend cardiac catheterization procedures and conferences; will perform complete "workups" of patients in preparation for catheterization, etc.; and will observe all hemodynamic and angiographic procedures. Dr. Ludbrook and Staff

(C) Cardiac Arrhythmias and Clinical Electrophysiology. Jewish Hospital. Provides the student with exposure and teaching in the diagnosis and treatment of complex rhythm disturbances. Dr. Crossen

(D) Cardiology/CCU. Jewish Hospital. Students will be introduced to cardiac graphics, electrocardiography, echocardiograms, and other non-invasive tests, then rotate through CCU as a subintern. Students are expected to perform initial evaluation and formulate management plan under resident's guidance, make brief oral presentations to CCU attendings. Night call every fourth night. Dr. M. Rich

(E) In-Patient Cardiology. Barnes Hospital. Students will participate as members of Barnes Cardiology, part of a team that sees a large population of cardiac patients and follows them through all aspects of their in-hospital care. Emphasis placed on physical examination and the interpretation of modern cardiac diagnostic tests in clinical decision making. Drs. Reiss, Barzilat and Braverman

(F) Research. Minimum of 12 weeks, all day.
1. Characterization of myocardial blood flow and metabolism during ischemia and reperfusion. Dr. S. Bergmann
2. Research in area of gene regulation, working with the M and B creatine kinase genes that are regulated during development of skeletal muscle and myocardium, currently elucidating the mechanisms by which the plasminogen activator inhibitor Type-1 gene is regulated by specific growth factors. Dr. Billadello
3. Delineation of mechanisms responsible for clinical arrhythmias, improved identification of patients at risk for developing sudden cardiac death, evaluation of new antiarrhythmic agents and pacing devices. Dr. Cain
4. Delineation of biochemical and electrophysiologic mechanisms responsible for arrhythmogenesis. Dr. Corr
5. (a) Clinical Elective: Performance and interpretation of exercise training measurement of oxygen uptake and cardiac output. Management of patients undergoing exercise training. (b) Research Elective: Physiology adaptations to exercise training in ischemic heart disease and effect of exercise training on age-related deterioration in cardiovascular function. Dr. Ehsani
6. Investigation of basic mechanisms of atherogenesis and cardiomyopathy. Focus is on intestinal metabolism of cholesterol and regulation of enzymes. Jewish Hospital. Dr. Lange
7. Hemodynamics, myocardial mechanics, and ventricular function (cardiac catheterization). Dr. Ludbrook
8. Ultrasonic assessment of cardiac structure and function including Doppler color flow imaging, and transesophageal imaging. Dr. Perez

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**Dermatology**

(A) Clinical Elective. Students will be rotated through the dermatology clinic with emphasis on the diagnosis and management of skin disorders, with special attention to skin diseases with systemic manifestations. Dr. Zucker

(B) Research Elective. Students will participate in research projects related to skin diseases and their pathogenesis. Dr. Zucker
Dermatology

(A) Clinical Clerkship. Students participate in outpatient care. Stress is placed on the dermatologic variations normally encountered, identification of common skin diseases, dermatologic clues to systemic disease, etc. Instruction is given in cutaneous histopathology and clinical mycology. Dr. Eisen and Staff

(B) Research. Minimum of 12 weeks, all day.
1. Proteolytic degradation of the extracellular matrix. Behavior of fibroblasts in a collagen lattice (skin equivalent). Dr. Eisen
2. Role of secreted extracellular matrix metalloproteases in tissue remodeling. Structure and function of metalloproteases. Dr. G. Goldberg
3. Biochemical studies on the control of cellular differentiation of the medically important systemic mycotic agents in particular Histoplasma capsulatum. Dr. Kobayashi
4. Mechanisms which cause metabolites of arachidonic acid to be produced after sunburn (ultraviolet injury) are being examined. Current emphasis on role of mast cell products in stimulating keratinocyte prostaglandin synthesis after ultraviolet light exposure and the signal transduction pathway by which this stimulation occurs. Dr. Pentland
5. Enzymology of extracellular neutral proteases and development of inhibitors. Effect of growth factors and cytokines on regulation of these proteases. Dr. Selzer

Emergency Medicine

Four weeks, Jewish Hospital. Senior student functions as member of E.D. staff, evaluating and treating patients in the E.D. Emphasis on Internal Medicine patients, minor surgery, and Gynecology cases. Dr. Zweemer

Gastroenterology

(A) Clinical Gastroenterology. Four weeks, all day. Students participate in the study of patients with a spectrum of digestive diseases, have responsibility for patients on whom consultations have been requested, observe biopsy, endoscopic and intubation techniques, and participate in the conferences and clinics run by the Division. Drs. Clouse and Zuckerman

(G) Research. Minimum of 12 weeks, all day.
1. Cell biology of polarized small intestinal epithelium; synthesis and secretion of intestinal proteins; regulation by dietary and hormonal factors in vivo and in cultured intestinal cells. Emphasis will be on unique secretory and transcellular pathways of alkaline phosphatase and cobalamin binding proteins. Dr. Alpers
2. Clinical applied research on viral hepatitis. Emphasis is placed on applying current immunological methodology to clinical and investigative studies of important and yet unanswered problems in the field of hepatitis, both acute and chronic. Dr. Perrillo
3. Human cellular immunology; effect of cytokines and peptides on normal human peripheral blood, tonsillar and splenic B cells; immunoregulation of intestinal B and T lymphocytes; transgenic mouse studies targeting cytokines to the intestine and liver; immune development in the intestine. Dr. Peters

General Internal Medicine

(A) Clerkship in Primary Care in General Internal Medicine is designed to provide the student with firsthand experience in general internal medicine practice in a model ambulatory care setting, the Health Key Medical Group of St. Louis. The major component of the clerkship is direct patient care under the supervision of senior internists who are members of the group. Dr. Scott Anderson and Staff

(B) Clerkship in General Internal Medicine in a small community without medical subspecialists (Keokuk, IA). Emphasis during preceptorship will be on ambulatory care. Students will work with three internists. Exposure will include consultations from general surgeons and family practitioners and other responsibilities of the general internal medicine group including treadmill exercise testing, echocardiograms, Holter Monitor analysis and interpretation, etc. Students will also have direct inpatient care responsibility including evaluation and treatment of admissions to the CCU. Drs. Austin, Davis and Hakes

(C) Medicine Clinic Outpatient Experience. Four half-day sessions in General Internal Medicine and two half-day sessions in a Medicine Specialty. A new clinic patient will be assigned to each student for workup, followed by presentation to the Attending Physician and Medical Resident/Fellow who will follow the patient after the student has finished the rotation. Discussion of each case will include diagnosis, further workup, therapy and follow-up care. Dr. Levitt
(D) Primary Care Medicine. Students will gain confidence in the ability to deliver first-contact care as well as ongoing care to ambulatory adult patients of all ages. Students will work with a more diverse range of patients than those encountered in most in-hospital rotations, thus providing a solid foundation for residency and future practice. Dr. Wren

Geriatric Medicine
Clinical Geriatrics. Six weeks or 4 weeks, all day. Students will make rounds at a nursing facility, participate in a clinic and outpatient assessment clinic. Attendance at research and clinical conferences and teaching rounds in geriatric medicine required. Drs. Binder, Birge, Price, and Staff

Hematology and Oncology
(A) Clinical Hematology. Six weeks, all day. Students receive intensive instruction in morphology, specialized diagnostic techniques, and management of patients with hematologic and oncologic disorders. Two separate clerkships are offered. Drs. Kornfeld, Majerus

(B) Clinical Oncology. Cochran VA Hospital. Four weeks, all day. Students receive major exposure to management of non-small cell and small cell lung cancer and of carcinoma of the colon, prostate, head, and neck. General oncological topics such as pain management, hypercalcemia of malignancy, malignant effusions, and neurooncology will be treated. Dr. Abbey, Hickman

(C) Clinical Hematology/Medical Oncology Consultation Service. Jewish Hospital. Six weeks, all day. Students will participate on the inpatient consultation service but equal emphasis will be given to the care of outpatients with cancer and hematologic disease. Specialized training in the management of patients with breast cancer and hematologic malignancies will be provided by the Marilyn Fixman Breast Center and Lymphoma Consultation Service. Emphasis will be given to principles of cancer management and to supportive, palliative treatment of symptomatic patients. Dr. Mortimer

(D) Oncology I - Barnes Hospital. In-patient consults and out-patient clinics. Training in the interdisciplinary management of general oncology patients. Scheduled site-specific interdisciplinary conferences with surgery and radiation for head and neck cancers, breast/gastrointestinal, lymphomas and thoracic malignancies. Dr. Mortimer

(E) Research. Minimum of 12 weeks, all day.
1. Biochemistry and mechanisms of action of the platelet-derived growth factor (PDGF). Dr. T. Denel
2. Biochemistry of mammalian cell surfaces; synthesis, processing and sorting of glycoproteins, including lysosomal enzymes. Drs. R. Kornfeld, S. Kornfeld
3. Biochemistry of platelets, regulation of lipid metabolism in tissue culture; mechanism of platelet thrombus formation. Dr. Majerus
4. Biochemical studies of interactions of plasma protease inhibitors with coagulation proteases. Dr. Tollefsen

Hypertension
Research. Individualized research project and/or participation in a community hypertension program. Dr. Perry

Immunology
(A) Allergy and Clinical Immunology. Students will participate in the allergy consult service at Barnes and Jewish Hospitals. They will be primary consult on a team and present patients to allergy fellows on call and the Attending Physician. In addition, they will participate in other on-going teaching activities in the division. Dr. H. J. Wedner and Staff

(B) Research. Minimum of 12 weeks, full-time.
1. Molecular and cellular biology of IL-1, and structure and function of the HLA complex. Dr. D. Chaplin
2. Molecular biology of antigen specific T-cell receptor. Dr. Lob
3. Biochemistry and molecular biology of molecules important in immediate hypersensitivity. Dr. C. Parker
4. Biology of Pollen of Fungal Allergies. Studies designed to characterize allergens from oak pollen and the spores of Epicoccum Nigrum, a common allergenic mold. Dr. Wedner
5. Psychosocial aspects of asthma. Dr. Wedner

Infectious Disease
(A) Clinical Infectious Diseases. Fundamentals of evaluating clinical problems in infection and formulating plans for workup and therapy. Students see consultations in infectious diseases in every part of Barnes and Jewish hospitals under supervision of faculty member. They work closely with medical residents and infectious disease fellows, follow own patients and play an important role in their management. Dr. Medoff

(B) Research
1. Study the molecular mechanisms controlling growth, differentia- tion, and outcome of cell culture models of immune response to irradiation. Dr. Reif
2. Develop the molecular mechanisms controlling growth, differentiation, and outcome of cell culture models of immune response to irradiation. Dr. Reif
3. Investigate the role of cytokines in regulating immune function. Dr. Reif
(B) Clinical AIDS. Study of treatment of HIV infection and associated opportunistic infections at Washington University AIDS Clinical Trial Unit. Dr. Foulgerly

(C) Research.
1. Investigations into the molecular mechanism for regulation of the function of phagocytic cells. Dr. E. Brown
2. The molecular biology of varicella-zoster virus. Varicella-zoster virus infection, latency, and oncogenicity. Dr. Gelb
3. Research focuses on the biochemistry of parasitic diseases. The organisms being studied include a protozoan which causes malaria, Plasmodium falciparum, and a helminth which causes ascariasis, Ascaris suum. Dr. Goldberg
4. Study of DNA replication in Herpes viruses, particularly Herpes simplex virus (HSV), overexpressed essential HSV replication gene in variety of heterologous systems and study of the role of the products of these genes in replication process by using genetic and biochemical methodologies. Dr. Paul Olivo
5. Intercellular communication in macrophages, membrane transporters of macrophages, purinergic receptors and the role of extracellular nucleotides in macrophage function. Dr. Steinberg
6. Research on issues at the interface of virology and immunology by analyzing aspects of immunity which control infection, and aspects of viral structure genetics which contribute to virulence and disease. We study both mucosal immunity to the dsRNA non-enveloped reoviruses and pathogenesis and latency of the much more complex dsDNA enveloped murine cytomegalovirus. Dr. Virgin

Laboratory Medicine

(A) Clinical Laboratory Medicine. Elective is designed to teach the student how the vast array of clinical assays are used in the diagnosis of disease and how the tests are actually performed in the clinical laboratory. Dr. Miletich

(B) Research.
1. Studies on the control of cellular differentiation of the medically important systemic mycotic agents in particular Histoplasma capsulatum. Dr. Kobayashi
2. Development and use of monoclonal antibodies to cardiac proteins. Dr. Ladenson
3. Investigation of a group of membrane proteins that utilize a novel glycoprophospholipid structure containing phosphatidylinositol as their mode of membrane anchoring. Research projects involve DNA cloning and sequencing, site-directed mutagenesis, and transfection to study the structure and function of this class of membrane proteins. Dr. Lublin
4. Laboratory interested in changes in the pattern of gene expression which occur during development of mammalian nervous system. Attention focused on trophic hormone, nerve growth factor (NGF), an agent which is critical for the survival and differentiation of sympathetic neurons. Dr. Milbrandt
5. Systematic study of the regions of the factor x molecule that mediate these interactions using a variety of traditional and novel cellular and molecular biological approaches, with particular emphasis on expression of recombinant proteins. Dr. Miletich
6. Study of antigen-driven B cell development by characterizing antibody response to H. influenza type b and by investigating B cell maturation, nature of T and B cell interaction, and cytokines operative in germinal centers of lymph nodes. Dr. Nahm
7. Analytical techniques and theoretical concepts underlying the field of medical decision analysis are investigated. Dr. Parvin
8. Research is aimed at defining the molecular mechanisms of cell-cell and cell-substrate adhesion. Investigations are centered on structure and function of adhesion receptor molecules in platelet function, development and malignancy. Dr. Santoro
9. Peripheral blood stem cell collection (PBSC); when, how, quality control. Techniques to automate autologous bone marrow and PBSC processing. Dr. Silva
10. Phospholipid-derived mediators and insulin secretion. The study of the process of glucose-induced insulin secretion by isolated pancreatic islets from rat and man. Focus on involvement of phospholipid-derived mediators in this signal transduction process. Involves gas chromatography-mass spectrometry. Dr. Turk

Medical Informatics
Research seminar series concerning literature surveys and medical informatics research conducted by the Division of Medical Informatics. Dr. Frisse and Staff

Metabolism and Endocrinology
(A) Clinical Clerkship. Students see inpatients and outpatients with endocrine and metabolic disease and participate in the rounds and conferences of the Metabolism Division. Dr. Cryer and Staff

(B) Research.
1. Studies of the physiology and pathophysiology of metabolic regulation in normal humans and patients with diabetes mellitus. Dr. Cryer
2. Major focus on understanding disorders of human growth with studies of growth hormone, the serum GH binding protein, the GH receptor, the insulin-like growth factors (IGFs), IGF binding protein, IGF action on fibroblasts. Dr. Daughaday
3. Regulation of plasma and body cholesterol levels studied in patients with atherosclerosis and hyperlipidemia. Whole body cholesterol metabolism and lipoprotein receptor structure, function and modification is investigated. Dr. Ostlund
4. Studies of genetic susceptibility to diabetes in man and experimental animal models through recombinant DNA techniques. Dr. Permutt
5. Molecular biology of growth hormone action; regulation of gene expression of members of the insulin-like growth factor family of peptides; growth factor action during cellular differentiation and development. Dr. Rotwein

Bone and Mineral Metabolism
(A) Jewish Hospital, Barnes Hospital, St. Louis Children's Hospital, the Veterans Affairs Medical Center and the St. Louis Shriners Hospital. Designed to acquaint students with clinical radiological and pathological manifestations of metabolic bone disease, disorders of calcitropic hormone (parathyroid hormone, vitamin D, calcitonin) hormone metabolism and activity, and to the current therapeutic concepts in skeletal disorders. Drs. Avioli, Civitelli, Pacifici, Whyte

(B) Research. Jewish Hospital Research Laboratories of the Washington University Division of Bone and Mineral Diseases, 7 Steinberg or the Shriners Hospital of St. Louis. Minimum of 12 weeks, all day. Research activities involve analyses of bone cell differentiation, growth and metabolism in tissue culture, as well as studies of signal transduction systems with emphasis on the relationship between cytokines, calcitropic hormones and osteoblast-osteoclast function. Drs. Avioli, Civitelli, Pacifici

Pharmacology/Medicine
Regulation at a transcriptional and translational level of the cyclo-oxygenase gene(s) by the lymphokines IL-1 and TNF. Isolation and functional organization of the bovine renal Na+/H+ exchanger(s). Dr. Morrison

Renal Disease
(A) Clinical Nephrology. Barnes Hospital, six weeks all day. Study of patients with renal disease and electrolyte disorders. They will also work up patients undergoing hemodialysis and renal transplantation. Dr. Hammerman and Staff

(B) Clinical Nephrology. Jewish Hospital. Students will be provided opportunity to evaluate patients on the renal consultant service, participate in daily clinical nephrology rounds, and participate in combined rounds. Dr. Hruska

(C) Mixed Clinical and Research Electives.
1. Clinical and metabolic studies in patients with renal disease and patients undergoing dialysis treatment. Dr. Delmez
2. Students will have opportunity to participate in basic research on molecular biology of proton pumps and proton transport by the kidney. Dr. Gluck
3. Role of atriopeptin (AP) in cardiovascular, fluid and electrolyte homeostasis. Students would become skilled in animal handling, cell culture, low and high pressure chromatography, immunoassays, RNA and DNA analysis hybridization and intimate knowledge of peptide biochemistry and renal physiology. Dr. Greenwald
4. Studies characterizing synthesis of polypeptide growth factors in renal tissue and the role(s) of polypeptide growth factors in renal development, growth and physiology. Dr. Hammerman
5. Bone remodeling and proximal tubular function. Students will participate in studies analyzing signal transduction by calcitropic hormones, the role of load regulated ion channels, and the mechanism of matrix/integrin mediated regulation. Dr. Hruska

Respiratory Medicine
(A) Barnes Hospital. Students acquire and follow patients through regular patient visits. Dr. Goodenough

(B) Jewish Hospital. Students work up and assist in cases and conferences. Dr. Klaas

(C) V.A. Hospital. Students work in the management of patients as chronic obstructive pulmonary disease, bronchitis, bronchogenic carcinoma, radiography. Dr. Klaas

(D) Medical Center. Opportunities to work in the care medical team. Dr. Klaas

7. Hormonal modulation of renal metabolism and the pathophysiological consequences of acute ureteral obstruction and chronically reduced renal mass. Dr. Klahr

8. Ionic channels underlying stimulus-response coupling of cells; metabolically-regulated channels in pancreatic islet cells; ion channels underlying volume regulation in neuroblastoma and plant cells; stretch-activated and hormone modulated channels in bone cells. Dr. Misler


10. Studies on the pathophysiology of acute and chronic renal failure in experimental models of renal disease. Dr. Purkerson

11. Immunopathology of renal diseases: Factors regulating infiltration of leukocytes in experimental kidney disease. Cellular mechanisms by which leukocytes particularly macrophages, affect the cell biology or renal cells. Dr. Schreiner

12. Studies investigate the interrelationships between vitamin D metabolites and parathyroid metabolism. Research projects include pathogenesis of secondary hyperparathyroidism. Studies on calcium binding protein (calbindin 9k) and calcium transport. Dr. Slatopolsky

Respiratory and Critical Care

(A) Barnes Hospital, four or six weeks. Students will acquire skills in the pulmonary function laboratory, follow patients with pulmonary diseases, attend regular pulmonary conferences. Drs. Schuster, Goodenberger and Staff

(B) Jewish Hospital, four or six weeks. Students will work up patients, interpret pulmonary function tests, assist in procedures, participate in teaching conferences and rounds. Drs. Senior, Lefrak and Staff

(C) V.A. Hospital, four weeks. Evaluation and management of common respiratory disorders such as chronic obstructive lung disease, lung cancer, tuberculosis. Preoperative evaluations, fiberoptic bronchoscopy, pulmonary function and chest radiographic interpretation, and ventilator management. Dr. C. Daugaday

(D) Medical/Respiratory Intensive Care (4 weeks). Opportunity to gain experience in acute, primary care medicine. Work up patients with the MICU team. Dr. Schuster

(E) Research Electives.

1. Mechanisms of asthma. Students will be introduced to biochemical and clinical studies of patients with asthma aimed at understanding the mechanisms of the disease and goals for the development of new treatment strategies. Dr. Holtzman

2. Positron emission tomographic studies of acute lung injury. Students will be introduced to large animal models of acute lung injury and techniques involving positron emission tomography, nuclear medicine and pulmonary physiology. Dr. Schuster

Section of Applied Physiology

(A) Clinical Elective. Exercise in Medicine and Preventive Medicine. Six weeks, all day. Students will participate as members of Applied Physiology Section’s clinical team, doing exercise-testing, with measurement of oxygen uptake and cardiac output, and metabolic studies; and working with patients with coronary artery disease, diabetes, and/ or hypertension who are undergoing exercise-training as part of their treatment. Drs. Ebsani, Holloszy, W. Martin

(B) Research Elective. Physiology and Biochemistry of Exercise. Research deals with the acute and chronic responses to exercise. Areas include biochemical adaptations in muscle in response to endurance exercise; cardiac adaptations to increased work load; the serum triglyceride lowering effect of exercise; the biochemical basis of muscle fatigue and the insulin-like effect of exercise. Drs. Holloszy and Ebsani

Section of Lipid Research

(A) Role of oxidative protein and lipid damage in pathogenesis of atherosclerosis mechanisms for generation of oxygen and carbon-centered free radicals. Dr. Hennecke

(B) Molecular genetics and pathophysiology of low LDL syndromes. Dietary and hormonal regulation of apolipoprotein production using cell biology and molecular techniques. Effect of exercise on lipoprotein levels, compositions and kinetics. Dr. Schonfeld

(C) Biochemistry and molecular biology of enzymes involved in fatty acid metabolism, specifically, lipoprotein lipase and fatty acid synthase; regulation of gene expression in human adipose tissue and skeletal muscle by exercise and diet; targeted inactivation of genes associated with adipocyte differentiation. Dr. Semenkovich
Faculty
Adolphus Busch Professor and Chairman of Department
David M. Kipnis, M.D., University of Maryland, 1951. (See Molecular Biology and Pharmacology.)
John E. and Adeline Simon Professor and Vice-Chairman of Department
Saulo Klahr, M.D., Universidad Nacional de Columbia, 1959.

Professors Emeriti
Hugh Chaplin, Jr., M.D., Columbia University, 1947. (See Department of Pathology.)
Irene E. and Michael M. Karl Professor of Endocrinology and Metabolism
William H. Daughaday, M.D., Harvard University, 1943.
Carl G. Harford, M.D., Washington University, 1933.
Virginia Minnich, M.S., Iowa State College, 1938.
Edward H. Reinhard, M.D., Washington University, 1939. (See Department of Radiology.)
Robert E. Shank, M.D., Washington University, 1939.

Professors
David H. Alpers, M.D., Harvard University, 1960.
John P. Atkinson (Howard Hughes Medical Institute Investigator in Medicine), M.D., University of Kansas, 1969. (See Department of Molecular Microbiology.)
Sydney M. and Stella H. Shoenberg Professor
Louis V. Avioli, M.D., Yale University, 1957.
Clifton A. Baile (Adjunct Professor of Nutrition in Medicine), Ph.D., University of Missouri, 1965.
Dennis M. Bier, M.D., New Jersey College of Medicine, 1966. (See Department of Pediatrics.)
John P. Boineau, M.D., Duke University, 1959. (See Department of Surgery.)
Elmer B. Brown, M.D., Washington University, 1950. (See Administration.)
Eric J. Brown, M.D. Harvard University, 1975. (See Departments of Cell Biology and Physiology and Molecular Microbiology.)
George J. Broze, Jr., M.D., Washington University, 1972.
Lewis R. Chace, M.D., Harvard University, 1964. (Chief, Washington University Medical Services, Cochran V.A. Hospital)
Peter B. Corr (Pharmacology), Ph.D., Georgetown University, 1975. (See Department of Molecular Biology and Pharmacology.)
Philip E. Cryer, M.D., Northwestern University, 1965. (Also Clinical Research Center)
William H. Danforth, M.D., Harvard University, 1951. (See Administration.)
Lewis T. and Rosalind B. Apple Professor of Oncology in Medicine
Thomas F. Deuel, M.D., Columbia University, 1961. (See Department of Biochemistry and Molecular Biophysics.)
Ali A. Ehsani, M.D., Tehran University, 1965. (See Irene Walter Johnson Institute of Rehabilitation.)
The Winfred A. and Emma R. Showman Professor of Dermatology
Arthur Z. Eisen (Dermatology), M.D., University of Pennsylvania, 1957.
Edward Geltman, M.D., New York University, 1971. (See Department of Pathology.)
Jeffrey I. Gordon, M.D., The University of Chicago, 1973. (See Departments of Biochemistry and Molecular Biophysics and Pharmacology.)
Richard W. Gross, M.D., New York University, 1976; Ph.D., Washington University, 1982. (See Department of Cell Biology and Pharmacology.) (Also Department of Chemistry.)
Chromalloy Professor of Renal Diseases in Medicine
Marc R. Hammerman, M.D., Washington University, 1972. (See Cell Biology and Pharmacology.)
John O. Holoosy, M.D., Washington University, 1957.
Ira M. Lang Professor of Nephrology
Keith A. Hruska, M.D., Creighton University, 1969. (See Cell Biology and Pharmacology.)
M. Kenton King, M.D., Vanderbilt University, 1951. (See Administration.)
George S. Kobayashi (Microbiology), Ph.D., Tulane University, 1963. (See Department of Molecular Biology.)
Rosalind H. Kornfeld, Ph.D., (Biochemistry), Washington University, 1961. (See Department of Biochemistry and Molecular Biophysics.)
Stuart A. Kornfeld, M.D., Washington University, 1962. (See Department of Biochemistry and Molecular Biophysics.)
Stanley J. Korsmeyer (Howard Hughes Medical Institute Investigator in Medicine), M.D., University of Illinois, 1976. (See Department of Molecular Microbiology.)
Jack H. Ladenson (Clinical Chemistry), Ph.D., University of Maryland, 1971. (See Department of Pathology.)
Louis G. Lange III, M.D., Harvard University, 1976; Ph.D., 1976. (See Department of Pathology.)
Stephen S. Lefrak, M.D., State University of New York, Downstate, 1965. (See Administration.)
J. Russell Little, Jr., M.D., University of Rochester, 1956. (See Department of Molecular Microbiology.)

Dennis M. Bier, M.D., University of Missouri, 1965. (See Department of Genetics.)
Philip A. Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Kenneth J. Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Philip W. Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Robert I. Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Gerald J. Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Joseph Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Thalas Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Anbrey Bier, M.D., University of Missouri, 1965. (See Department of Molecular Biology.)
Patrick Bier, M.D., University of California, 1965. (See Department of Pathology.)
Clare Bier, M.D., University of California, 1965. (See Department of Pathology.)
William Bier, M.D., University of California, 1965. (See Department of Pathology.)
Julio E. Bier, M.D., University of California, 1965. (See Department of Pathology.)
M. Alan Bier, M.D., University of California, 1965. (See Department of Pathology.)
Robert P. Bier, M.D., University of California, 1965. (See Department of Pathology.)
H. Mitch Bier, M.D., University of California, 1965. (See Department of Pathology.)
Selena and Herman Seldin
Professor of Medicine
John A. Pierce, M.D., University of Arkansas, 1948.
Mabel L. Purkerson, M.D., Medical College of South Carolina, 1956. (See Administration and Department of Pediatrics.)
Julio V. Santiago, M.D., University of Puerto Rico, 1967. (See Department of Pediatrics.)
Samuel A. Santoro, M.D., Ph.D., Vanderbilt University, 1979. (See Department of Pathology.)
David Schlessinger (Microbiology), Ph.D., Harvard University, 1960. (See Department of Molecular Microbiology.)
William B. Kountz Professor of Medicine
Gustav Schonfeld, M.D., Washington University, 1960.
Dorothy R. and Hubert C. Moog Professor in Pulmonary Medicine
Barry A. Siegel, M.D., Washington University, 1969. (See Department of Radiology.)
Louis Simchowitz, M.D., New York University, 1970. (See Department of Cell Biology and Physiology.)
Joseph Friedman Professor of Renal Diseases in Medicine
Eduardo Slatopolsky, M.D., University of Buenos Aires, 1959.
The Tobias and Hortense Levin Professor of Cardiovascular Diseases
Burton E. Sobel, M.D., Harvard University, 1962.
Howard G. Welgus, M.D. (Dermatology), Washington University, 1977.

Research Professors
Joseph J.H. Ackerman, Ph.D. (Chemistry), Colorado State University, 1977.
Irene E. Karl, Ph.D., University of Wisconsin, 1940.
James G. Miller, Ph.D., Washington University, 1969. (Also Faculty of Arts and Sciences)
Jeremiah J. Morrissey, Ph.D., St. Louis University, 1974.
Una S. Ryan, Ph.D., Cambridge University, 1968. (See Departments of Cell Biology and Physiology and Surgery.)
Alexander Strongin (Visiting Research Professor of Biochemistry in Medicine Dermatology), Ph.D., All Union Research Institute, Moscow.

Professors Emeriti (Clinical)
Ralph V. Gieselman, M.D., Washington University, 1947.
Paul O. Hagemann, M.D., Washington University, 1934.
Morris D. Marcus (Dermatology), M.D., Washington University, 1934.
Franz U. Steinberg, M.D., University of Berne, 1938. (See Department of Surgery.)

Professors (Clinical)
I. J. Flance, M.D., Washington University, 1935.
Neville Grant, M.D., Columbia University, 1954.
Harold J. Joseph, M.D., University of Texas, 1950.
Michael M. Karl, M.D., University of Louisville, 1938.
Philip E. Korenblat, M.D., University of Arkansas, 1960.
Marvin E. Levin, M.D., Washington University, 1951.
Virgil Loeb, Jr., M.D., Washington University, 1944.
G. Charles Oliver, M.D., Harvard University, 1957.
Robert Paine, M.D., Harvard University, 1944.
Benjamin Schwartz, M.D., Ph.D., Albert Einstein College of Medicine, 1972.
Burton A. Shatz, M.D., Washington University, 1943.

**Associate Professor Emeritus**
Norma Fletcher, Ph.D., University of Copenhagen, 1965.

**Associate Professors**
Elliot E. Abbey, M.D., (Clinical Academic), New York University, 1975.
Steven R. Bergmann (Medical Physiology), Ph.D., Hahnemann Medical College, 1977; M.D., Washington University, 1985.
Joseph Billadello, M.D., Georgetown University, 1978.
Michael E. Cain, M.D., George Washington University, 1975.
David D. Chaplin (Howard Hughes Medical Institute Associate Investigator), M.D., Ph.D., Washington University, 1980. (See Departments of Molecular Microbiology and Genetics.)
Ray E. Clouse, M.D., Indiana University, 1976.
William E. Clutter, M.D., Ohio State University, 1975. (Also Clinical Research Center)
Carlos C. Daughaday (Clinical Academic), M.D., Washington University, 1971.
Seth A. Eisen, M.D., (Clinical Academic), Washington University, 1966.
Paul R. Eisenberg, M.D., New York Medical College, 1980.
Mark E. Frisse, M.D., Washington University, 1978. (See Biomedical Computing.)
Lawrence D. Gellb, M.D., Harvard University, 1967. (See Department of Molecular Microbiology.)
Stephen J. Giddings, Ph.D., Dartmouth, 1973; M.D., University of Rochester, 1976.
Stephen L. Gluck, M.D., University of California, 1977. (See Department of Cell Biology and Physiology.)
Gregory I. Goldberg (Dermatology), Ph.D., Weizmann Institute of Science, 1977. (See Departments of Biochemistry and Molecular Biophysics and Molecular Microbiology.)
Gregory A. Grant (Dermatology), Ph.D., University of Wisconsin, 1975. (See Department of Biochemistry and Molecular Biophysics.)
Samuel B. Guze, M.D., Washington University, 1945. (See Department of Psychiatry.)
Scot G. Hickman (Clinical Academic), M.D., Washington University, 1970.
V. Michael Holers, M.D., Howard Hughes Medical Institute (Assistant Investigator), Washington University, 1978. (See Department of Pathology.)
Michael J. Holtzman, M.D., Northwestern University, 1975.
Donald J. Krogsdal, M.D., Harvard University, 1969. (See Department of Pathology.)
(Director of Microbiology Laboratory, Barnes Hospital)
Anthony Kulkosky, Jr., M.D., Harvard University, 1970. (See Department of Molecular Microbiology.)
Timothy J. Ley, M.D., Washington University, 1978. (See Department of Genetics.)
Ellen Li, Ph.D., M.D., Washington University, 1980. (See Department of Biochemistry and Molecular Biophysics.)
Bruce Lindsay, M.D., Jefferson Medical College, 1977.
Susan B. Mallory (Dermatology), M.D., University of Texas, Galveston, 1974. (See Department of Pediatrics.)
Bruno Maresca (Visiting), Ph.D., University of Naples, Naples, Italy, 1974.
Jeffrey D. Milbrandt, M.D., Washington University, 1978; Ph.D., University of Virginia, 1985. (See Department of Pathology.)
Stanley Misler, M.D., Ph.D., New York University, 1977. (See Cell Biology and Pathology.)
Joanne Mortimer, M.D., Loyola University Stritch School of Medicine, 1977.
Moon H. Nahm, M.D., Washington University, 1974. (See Department of Pathology.)
Richard E. Ostlund, Jr., M.D., University of Utah, 1970.
Alice Pentland (Dermatology), M.D., University of Michigan, 1978. (See Department of Molecular Biology and Pharmacology.)
Marion G. Peters, M.B.B.S., Melbourne University, 1972. (See Department of Molecular Microbiology.)
Lee Ratner, M.D., Ph.D., Yale University, 1979. (See Department of Molecular Microbiology.)
John C. Rogers, M.D., University of Nebraska, 1968. (Also Department of Pathology.)
Peter S. Rotwein, M.D., Albert Einstein College of Medicine, 1975. (See Department of Genetics.)
J. Evan Sadler (Howard Hughes Medical Institute Associate Investigator in Medicine), Ph.D., Duke University, 1978; M.D., 1979. (See Department of Biochemistry and Molecular Biophysics.)
Jeffrey E. Saffitz, Ph.D., Case Western Reserve University, 1977; M.D., 1978. (See Department of Pathology.)
George F. Schreiner (Established Investigator of the American Heart Association), M.D., Ph.D., Harvard University, 1977. (See Department of Pathology.)
Daniel P. Schuster, M.D., Yale University, 1976.
Isaias Spilberg, M.D., University of Texas, San Marcos, 1963.

**Research Professors**
Dana R. Anderson, Ph.D., Purdue University, Biology and Biochemistry.
H. Dietrich, M.D., University of California, Los Angeles, Molecular Biology.
Janina M. Miller, M.D., University of Kentucky, Psychology.
Thomas S. O'Donnell, Ph.D., University of Michigan, Biochemistry.
Edwin B. Stein, Ph.D., State University of New York, Biological Psychology.
Osmi K. Okada, Ph.D., University of Tokyo, Psychiatry.

**Associate Professor Emeritus**

Gregory I. Goldberg (Dermatology), Ph.D., Weizmann Institute of Science, 1977. (See Departments of Biochemistry and Molecular Biophysics and Molecular Microbiology.)
Gregory A. Grant (Dermatology), Ph.D., University of Wisconsin, 1975. (See Department of Biochemistry and Molecular Biophysics.)
Samuel B. Guze, M.D., Washington University, 1945. (See Department of Psychiatry.)
Scot G. Hickman (Clinical Academic), M.D., Washington University, 1970.
V. Michael Holers, M.D., Howard Hughes Medical Institute (Assistant Investigator), Washington University, 1978. (See Department of Pathology.)
Michael J. Holtzman, M.D., Northwestern University, 1975.
Donald J. Krogsdal, M.D., Harvard University, 1969. (See Department of Pathology.) (Director of Microbiology Laboratory, Barnes Hospital)
Anthony Kulkosky, Jr., M.D., Harvard University, 1970. (See Department of Molecular Microbiology.)
Timothy J. Ley, M.D., Washington University, 1978. (See Department of Genetics.)
Ellen Li, Ph.D., M.D., Washington University, 1980. (See Department of Biochemistry and Molecular Biophysics.)
Bruce Lindsay, M.D., Jefferson Medical College, 1977.
Susan B. Mallory (Dermatology), M.D., University of Texas, Galveston, 1974. (See Department of Pediatrics.)
Bruno Maresca (Visiting), Ph.D., University of Naples, Naples, Italy, 1974.
Jeffrey D. Milbrandt, M.D., Washington University, 1978; Ph.D., University of Virginia, 1985. (See Department of Pathology.)
Stanley Misler, M.D., Ph.D., New York University, 1977. (See Cell Biology and Pathology.)
Joanne Mortimer, M.D., Loyola University Stritch School of Medicine, 1977.
Moon H. Nahm, M.D., Washington University, 1974. (See Department of Pathology.)
Richard E. Ostlund, Jr., M.D., University of Utah, 1970.
Alice Pentland (Dermatology), M.D., University of Michigan, 1978. (See Department of Molecular Biology and Pharmacology.)
Marion G. Peters, M.B.B.S., Melbourne University, 1972. (See Department of Molecular Microbiology.)
Lee Ratner, M.D., Ph.D., Yale University, 1979. (See Department of Molecular Microbiology.)
John C. Rogers, M.D., University of Nebraska, 1968. (Also Department of Pathology.)
Peter S. Rotwein, M.D., Albert Einstein College of Medicine, 1975. (See Department of Genetics.)
J. Evan Sadler (Howard Hughes Medical Institute Associate Investigator in Medicine), Ph.D., Duke University, 1978; M.D., 1979. (See Department of Biochemistry and Molecular Biophysics.)
Jeffrey E. Saffitz, Ph.D., Case Western Reserve University, 1977; M.D., 1978. (See Department of Pathology.)
George F. Schreiner (Established Investigator of the American Heart Association), M.D., Ph.D., Harvard University, 1977. (See Department of Pathology.)
Daniel P. Schuster, M.D., Yale University, 1976.
Isaias Spilberg, M.D., University of Texas, San Marcos, 1963.
Emeritus (Clinical)

Associate Professors

Mary I. Parker, M.D., Washington University, 1953.

Associate Professors (Clinical)

Jack Barrow, M.D., Washington University, 1946.

Benjamin A. Borowsky, M.D., Washington University, 1958.


Arnold Dankner, M.D., Washington University, 1947.

John D. Davidson, M.D., Washington University, 1972.

Arthur H. Gale, M.D., University of Missouri, 1959.

Siddhesh Gowda, M.B., B.S., Medical College Bellary Mysore, 1969.

John M. Grant, M.D., Washington University, 1954.

James N. Heins, M.D., University of Louisville, 1961.


Owen S. Kantor, M.D., University of Missouri, 1968.

Robert W. Karr, M.D., University of Texas, 1975.


John J. Kelly, M.D., St. Louis University, 1963.

Charles Kilo, M.D., Washington University, 1959.

Norman P. Knowlton, Jr., M.D., Harvard University, 1945.


David M. Lieberman, M.D., Vanderbilt University, 1949.

Harvey Liebhaber, M.D., New York University, 1957.

Herbert Lubowitz, M.D., Washington University, 1958.

Alan P. Lyss, M.D., Washington University, 1976.


Edward J. Miller, M.D., St. Louis University, 1962.


Gary A. Ratkin, M.D., Washington University, 1967. (See Department of Radiology.)

Lester T. Reese (Dermatology), M.D., Tulane University, 1966.

Ernest T. Rouse, M.D., Washington University, 1943.

Shabbir H. Saifdar, M.D., Nishtar Medical College, 1961.

Llewellyn Sale, Jr., M.D., Washington University, 1940.

Ali Salimi, M.D., University of Tehran, 1965.

James C. Sisk (Dermatology), M.D., Washington University, 1946.

Ross B. Sommer, M.D., Cornell University, 1949.

J. Allen Thiel, M.D., St. Louis University, 1960.

Stanley M. Wald, M.D., Washington University, 1946.

Alan N. Weiss, M.D., Ohio State University, 1966.

Alvin S. Wenneker, M.D., Washington University, 1953.

Research Associate Professors

Dana R. Abendschein, Ph.D., Purdue University, 1978. (See Cell Biology and Physiology.)

H. Dieter Ambos, C.E.E., Washington University, 1973. (See Biomedical Computing.)

Janina M. Brajburg, Ph.D., University of Lodz, 1969.

Thomas G. Cole, M.D., University of Missouri, 1974; Ph.D., 1980. (See Biochemistry.)

Edwin B. Fisher (Psychology), Ph.D., State University of New York, 1972. (See Department of Psychology.)

Osami Kanagawa, M.D., Okayama University, 1974; Ph.D., 1978. (See Department of Pathology.)

Associate Professors Emeriti (Clinical)

Grace E. Bergner, M.D., Washington University, 1943.

Joseph C. Edwards, M.D., Harvard University, 1934.
Raymond E. Bourey, M.D., Southern Illinois University, 1982.
Alan Braverman, M.D., University of Missouri, Kansas City, 1985.
Randy Brown, M.D., Case Western Reserve University, 1979.
Robert Civitelli, M.D., Siena University, Siena, Italy, 1980.
Steven M. Cohn, M.D., Ph.D., Washington University, 1985.
Patricia L. Cole, M.D., Harvard University, 1981.
Wenyong Cui (Visiting Staff), M.D., Beijing Medical College, 1961.
Victor G. Davila, M.D., University of Puerto Rico, 1981.
Douglas C. Dean, Ph.D., University of Kansas, 1981. (See Cell Biology and Pharmacology.)
William C. Dunagan, M.D., Washington University, 1983.
Robert Dunlay, M.D., Creighton University, 1982.
Steven Edmundowicz, M.D., Jefferson Medical College, 1983.
Alex S. Evers, M.D., New York University, 1978. (See Departments of Anesthesiology, Molecular Biology and Pharmacology.)
Paula Fracasso, M.D., Ph.D., Yale University, 1984.
Victoria Fraser, M.D., University of Missouri, 1983.
Steven M. Frisch (Dermatology), Ph.D., University of California, Berkeley, 1984. (See Biochemistry and Molecular Biophysics.)
Anne C. Goldberg, M.D., University of Maryland, 1977.
Daniel E. Goldberg, M.D., Ph.D., Washington University, 1985. (See Molecular Microbiology.)
James A. Goldstein, M.D., The University of Chicago School of Medicine, 1976.
Daniel M. Goodenberger, M.D., Duke University, 1974.
Eric D. Green, M.D., Ph.D., Washington University, 1987. (See Department of Pathology.)
James E. Greenwald, Ph.D., Ohio State University School of Medicine, 1980; M.D., 1983. (See Department of Pharmacology.)
Robert John Gropler, M.D., University of Cincinnati, 1981.
David Hagerty, M.D., St. Louis University, 1981.
James R. Hansbrough, Ph.D., Vanderbilt University, 1980; M.D., Washington University, 1983. (See Department of Pediatrics.)
Jay Heinecke, M.D., Washington University, 1981.
George J. Hruza (Dermatology), M.D., New York University, 1982. (See Department of Surgery and Otolaryngology.)
Michael G. Kahn, M.D., University of California, San Diego, 1979; Ph.D., University of California, San Francisco, 1988. (See Biomedical Computing.)
Joseph L. Kenzora, M.D., University of New Mexico School of Medicine, 1975.
Paula M. Kinnenen, M.D., Harvard Medical School, 1981.
Sandor J. Kovacs, Ph.D., California Institute of Technology, 1977; M.D., University of Miami, 1979.
John M. Lasala, Ph.D., St. Louis University, 1979; M.D., University of Connecticut, 1983.
James B. Lefkowitz, M.D., The Johns Hopkins University, 1979. (See Molecular Biology and Pharmacology.)
Marc S. Levin, M.D., Columbia College of Physicians and Surgeons, 1981.
Michael B. Lippman (Clinical Academic), M.D., State University of New York, 1977.
Douglas M. Lublin, Ph.D., Stanford University, 1976; M.D., University of California, Los Angeles, 1982. (See Department of Pathology.)
Charles Lucore, M.D., Duke University, 1983.
Janet McGill, M.D., Michigan State University, 1979. (See Department of Pediatrics.)
Robert C. McAlister, M.D., Washington University, 1961. (See Department of Radiology.)
Ann Martin (Dermatology), M.D., Case Western Reserve University, 1981.
Wade H. Martin, M.D., University of Kansas, 1977.
Stephen B. Miller, M.D., University of Missouri, Kansas City, 1983.
Roberto Pacifici, M.D., Perugia University School of Medicine, Perugia, Italy, 1981.
William C. Parks, Ph.D., Medical College of Wisconsin, 1982.
Anders V. Persson, Ph.D., University of Colorado, 1977; M.D., University of Miami School of Medicine, 1983.
Jill Pichon, M.D., Harvard University, 1984.
Steven M. Pogwizd, M.D., Washington University, 1981.
Katherine Ponder, M.D., Washington University, 1983. (See Biochemistry and Molecular Biophysics.)
Craig K. Reiss, M.D., University of Missouri, Kansas City, 1983.
Marcos Rothstein, M.D., University of Zulia, 1974.


Deborah G. Rubin, M.D., Albert Einstein College of Medicine, 1981.

Clay Senukovich, M.D., Washington University, 1981. (See Cell Biology and Physiology.)

Steven Shapiro, M.D., The University of Chicago, 1983.

Jeffrey N. Rottman, M.D., Columbia University, New York, 1978. (See Cell Biology and Physiology.)

Heather M. White, M.D., University of Texas, Houston, 1985.

Herbert W. Virgin IV, M.D., Ph.D., Harvard University, 1985. (See Department of Molecular Microbiology.)

Thomas H. Steinberg, M.D., New York University, 1978. (See Department of Cell Biology and Physiology.)


Samuel L. Stanley, M.D., Harvard University, 1980. (See Department of Molecular Microbiology.)

Heather M. White, M.D., University of Texas, Houston, 1985.

Samuel A. Wickline, M.D., University of Hawaii, 1980.

David W. Windus, M.D., Creighton University, 1978.


Robert A. Wolf, M.D., Harvard University, 1980.

Research Assistant Professor Emeritus

Ida K. Mariz, A.B., Washington University, 1940.

Research Assistant Professors

Thomas W. Allen (Education), Ed.D., Harvard University, 1966. (Also Graduate Institute of Education)

Cynthia Lee Arifken, Ph.D., Yale University, 1985. (See Biostatistics.)

Puran S. Bora, Ph.D., Kumaun University, India, 1984.

Alex J. Brown, Ph.D., University of Tennessee, 1982.


Ivan E. Collier, Ph.D., Florida State University, 1980.


Mary Anne Della-Fera (Adjunct), V.M.D., University of Pennsylvania, 1979; Ph.D., 1980.

Adriana Dusso, Ph.D., University of Rosan, Argentina, 1985.

Kenton N. Fedde, Ph.D., The University of Chicago, 1983.

David A. Ford, Ph.D., University of Missouri, 1984.

Satoshi Fujii, M.D., Hokkaido University, 1987.

Stephen J. Gaioni (Psychology), Ph.D., Princeton University, 1976.

Eric A. Gulve, Ph.D., Harvard University, 1987.


Fong Fu Hsu, Ph.D., University of Utah, 1986.

Wendy M. Kohrt, Ph.D., Arizona State University, Tempe, 1986.

Elaine S. Krul, Ph.D., McGill University, 1982.

Michelle Lennartz, Ph.D., University of Michigan, 1984.

Grace S. Lo (Adjunct), Ph.D., University of Texas, Austin, 1976.


Carol L. McLaughlin (Adjunct), Ph.D., University of Pennsylvania, 1981.

Theodore W. Munns, Ph.D., St. Louis, University, 1970.

Curtis A. Parvin (Clinical, Computer Science), Ph.D., University of Minnesota, 1980. (See Department of Pathology and Division of Biostatistics.)

Kenneth B. Schechtman, Ph.D., Washington University, 1978. (See Division of Biostatistics and Institute for Biomedical Computing.)

Mitchell G. Scott (Clinical), Ph.D., Washington University School of Medicine, 1982. (See Department of Pathology.)

Jo L. Seltzer (Dermatology), Ph.D., Washington University, 1969.

David Sherman, Ph.D., Vanderbilt University, 1987. (See Molecular Microbiology.)

Victor A. Silva (Clinical), M.D., St. Louis University, 1971. (See Department of Pathology.)

Curtis A. Spilburg, Ph.D., Northwestern University, 1972.


Raj Ajit Srivastava, Ph.D., Gorakhpur University, India, 1983.

Kathryn A. Yamada, Ph.D., Georgetown University, 1982.

Assistant Professors Emeriti (Clinical)

Morris Alex, M.D., Washington University, 1943.

Duane E. Cozart, M.D., Medical College of Virginia, 1959.

William K. Hall (Dermatology), M.D., Washington University, 1942.

James H. Hutchinson, Jr., M.D., University of Arkansas, 1945.


Warren Lonergan, M.D., Vanderbilt University, 1941.

Harold K. Roberts, M.D., Ohio State University, 1939.

Samuel Schechter, M.D., Washington University, 1941.

Assistant Professors (Clinical)

Charles C. Abel, M.D., Washington University, 1956.

Gail A. Ahumada, M.D., University of California, San Diego, 1972.

Louis F. Aitken, M.D., Washington University, 1927.

Howard J. Aylward, Jr., M.D., Vanderbilt University, 1970. (See Medical Care Group.)
Donald K. King, M.D., The Johns Hopkins University, 1970. (See Health Key Medical Group.)
John H. Kissel, M.D., Harvard University, 1971.
Micki Klearman, M.D., Washington University, 1981.
Ralph F. Kuhlman, M.D., University of Illinois, 1964. (Also Student Health Service)
Cathy Lazarus, M.D., Washington University, 1981. (See Employee Health Service.)
Steven A. Lauter, M.D., Wayne State University, 1971.
Douglas R. Lilly, M.D., Washington University, 1956.
Carl A. Lyss, M.D., Washington University, 1956.
Thomas F. Martin, M.D., St. Louis University, 1965.
J. Roger Nelson, M.D., Washington University, 1953.
Matthew J. Orland, M.D., University of Miami, 1970.
David W. Ortbals, M.D., Washington University, 1970.
Deborah Parks, M.D., University of Louisville, 1982.
MaryBeth Pereira, M.D., University of California, 1978.
Daniel E. Potts, M.D., Washington University, 1972.
Vincent J. Proskey, M.D., Marquette University, 1964.
Leon R. Robison, M.D., Case Western Reserve University, 1968.
Scott R. Sale, M.D., St. Louis University, 1976.
Robert Shuman, M.D., University of Missouri, 1981.
Donald A. Skor, M.D., Medical College, 1978.
Rand W. Sommer, M.S., Washington University, 1980.
Alan R. Spivack, M.D., St. Louis University, 1964.
Linda G. Stanton, M.D., Boston University, 1971.
Paul M. Stein, M.D., St. Louis University, 1973.
Kongsak Tanphaichitr, M.D., Siraraj Hospital Medical School, 1970.
James Regan Thomas (Dermatology), M.D., University of Missouri 1972. (See Department of Otolaryngology.)
Jeffrey Tillinghast, M.D., Washington University, 1980.
Elliot A. Wallach (Dermatology), M.D., St. Louis University, 1945.
James W. Walsh, M.D., Washington University, 1954.
John A. Wood, M.D., Oklahoma University, 1968.
Herbert B. Zimmerman, M.D., Washington University, 1951.
Instructors
Matthew A. Arquette, M.D., Washington University, 1986.
Michael Berkoben, M.D., University of Pennsylvania, 1986.
Thomas M. Birkenmeier, M.D., Washington University, 1982.
Greta Camel, M.D., University of Wisconsin, 1949.
Thomas Chambers, M.D., Harvard University, 1982.
Karl J. Crossen, M.D., University of South Alabama, 1981.
Thomas DeFar, M.D., University of Missouri, Columbia, 1989.
Charles S. Eby, M.D., Vanderbilt University, 1981. (See Department of Pathology.)
Larry E. Fields, M.D., Harvard University, 1980.
Karen E. Forsman (Dermatology), Rush Medical College, 1981.
John Frattini, M.D., Washington University, 1986.
Irene L. Graham, M.D., Baylor College of Medicine, 1982.
Renee Kanan, M.D., Washington University, 1986.
Rosemarie Lajara, M.D., University of Puerto Rico School of Medicine, 1983.
Michelle Lennartz, Ph.D., University of Michigan, 1984.
Elizabeth McGuire, M.D., Jefferson Medical College, 1980.
Terry McNearney, M.D., St. Louis University, 1981.
Naresh Mody, Ph.D., M.D., Universidad Autonoma de Cd Juarez Cd, Mexico, 1985.
Kenneth J. Phillips, M.D., Medical College of Wisconsin, 1986.
Susan C. Price, M.D., St. Louis University, 1984.
Antonella Quattramani, M.D., Perugia University School of Medicine, Italy, 1982.
Patricia Quinley, M.D., University of Illinois, Chicago, 1989.
Glenn Rosen, M.D., University of Pennsylvania, 1983.
David Schleinkofer, M.D., Washington University, 1989.
Arik Shakir, M.D., Madras Medical College, 1982.
Sherry Shuman, M.D., Wayne State University, 1982.
William D. Staatz, M.D., University of Edinburgh, 1976. (See Department of Pathology.)
Alison I. Whelan, M.D., Washington University, 1986.

Research Instructors
Ian Anderson, R.M., Centennial College of Applied Arts and Technology, Canada, 1976.
Ramawamy Chandrashekar, Ph.D., University of Bombay, India, 1988.
Su-Li Cheng, Ph.D., University of Louisville, 1978.
Randall L. Duncan, Ph.D., Oklahoma State University, 1983.
Ronald L. Gingerich, Ph.D., Indiana University, 1975. (See Department of Pediatrics.)
Thomas J. Girard, Ph.D., Iowa State University, 1985.
Ellen B. Heath-Monnig, Ph.D., Case Western Reserve University, 1981.
Pilar Herrero, M.S., (Cardiology), Vanderbilt University, 1984.
Norma J. Janes, M.S., State University of Iowa, 1964. (Also Clinical Research Center)

Marjorie C. Louie, M.D., Ph.D., The University of Chicago, 1981.
Marylen L. Mann, M.A., Washington University, 1959.
Barbara A. Pfleger, B.S., St. Louis University, 1957.
Neil F. Rebbe, Ph.D., Washington University, 1983.
Terrence E. Richl, Ph.D., Ohio University, 1980.
Sharon A. Rogers, M.S., Southern Illinois University, 1983.
Suresh D. Shah, M.S., St. Louis University, 1972. (Also Clinical Research Center)
Carol Stubblefield, MSN, St. Louis University, 1982.
Linda K. Sussman, Ph.D., Washington University, 1983.
Bakula L. Trivedi, M.S., Gujarat University, India, 1961.
Daniel M. Wojya, Ph.D., University of Toledo, 1988.
Joseph W. Yang, Ph.D., Illinois State University, 1976.
Kevin E. Yarasheski, Ph.D., Kent State University, 1986.

Instructors Emeriti (Clinical)
Edward W. Cannady, M.D., Washington University, 1931.
Axel R. Gronau, M.D., University of Naples, 1935.
Richard W. Maxwell, M.D., The University of Chicago, 1937.
Lamar H. Ochs, M.D., Washington University, 1944.
Hugh R. Waters, M.D., Washington University, 1945.
Herbert C. Wiegand, M.D., Washington University, 1943.
Instructors (Clinical)

Barry K. Abramson, M.D., University of Miami, 1985.
Ingrid R. Albert (Dermatology), M.D., Albert Einstein College of Medicine, 1971.
Frank K. Anderson, M.D., Northeastern University School of Medicine, 1980. (See Health Key Medical Group.)
Scott J. Anderson, Ph.D., Duke University, 1981; M.D., 1982. (See Health Key Medical Group.)
Jerome M. Aronberg (Dermatology), M.D., Washington University, 1971.
Milton F. Austin, M.D., Yale University, 1980.
David Ban, M.D., University of Oregon, 1980.
Frederick D. Bauschard (Dermatology), M.D., University of Pittsburgh, 1968.
Susan Berdy, M.D., St. Louis University, 1984.
Michael A. Berk, M.D., Indiana University, 1979.
Aaron M. Bernstein, M.D., Chicago Medical School, 1952.
Ellen F. Binder, M.D., Washington University, 1981.
Aaron Birenbaum, M.D., Washington University, 1948.
Joyce E. Boehmer, M.D., University of Missouri, 1979. (See Health Key Medical Group.)
Scott A. Brodarick, M.D., University of Illinois, 1975.
Jeffrey S. Brooks (Podiatry), D.P.M., New York College of Podiatric Medicine, 1974.
Kathleen S. Brunts, M.D., St. Louis University, 1981. (See Health Key Medical Group.)
John M. Cary, M.D., St. Louis University, 1958.
Duck Sung Chun, M.D., Seoul National University College of Medicine, 1969.
Gail L. Clark, M.D., St. Louis University, 1974.
Frank Cohen, M.D., University of Toronto, 1939.
Charles Crecelius, Ph.D., St. Louis University, 1984; M.D., 1984.
Robert B. Cusworth, M.D., University of Rochester, 1974.
Rand E. Dankner, M.D., Baylor College of Medicine, 1978.
Wilson L. Davis, Jr., M.D., University of Iowa College of Medicine, 1978.
Thomas A. Dew, M.D., University of Arkansas, 1967.
Kathryn M. Diemer, M.D., University of Missouri, Kansas City, 1985.
Jacquelyn M. Dilworth (Dermatology), M.D., Howard University, 1985.
Thomas D. Doerr, M.D., The University of Chicago, 1983. (See Health Key Medical Group.)
Irl J. Don, M.D., Washington University, 1972. (See Health Key Medical Group.)
James W. Donnelly, (Dermatology), Washington University, 1986.
Royal J. Eaton, M.D., University of Missouri, 1964.
Carol F. Evers, M.D., Brown University, 1977.
Michael J. Fedak, M.D., University of Missouri, 1982. (See Health Key Medical Group.)
David Feldman, M.D., Washington University, 1943.
Norman Fishman, M.D., Columbia College of Physicians and Surgeons, 1974.
B. Todd Forsyth, M.D., Washington University, 1947.
Kathleen M. Garcia, M.D., Harvard University, 1980.
William M. Gee, M.D., Washington University, 1981.
Kenneth W. Gentsch, M.D., Washington University, 1958.
Matthew L. German, M.D., Robert Woods Johnson School of Medicine, 1988.
C. Bruce Graves, M.D., Washington University, 1988.
Nancy Z. Guggenheim, M.D., Brown University, 1980. (See Health Key Medical Group.)
Thomas E. Hakes, M.D., University of Iowa College of Medicine, 1978.
Anne Herron, M.B., B.Ch., Dalh University, 1965.
William E. Hinkley, M.D., Harvard University, 1969.
Paul F. Hintze, M.D., University of Utah, 1978.
Sandra S. Hoffman, M.D., University of Kansas, 1976.
Bruce J. Hookerman (Dermatology), M.D., St. Louis University, 1968.
Barbara A. Horn, M.D., Medical College of Pennsylvania, 1979.
John W. Hubert, M.D., Washington University, 1975.
Richard F. Huck, M.D., Washington University, 1948.
Daryl L. Jacobs, M.D., University of Washington, 1983.
Myron H. Jacobs, M.D., University of California, San Diego, 1969.
Ingrid M. Keleti, M.D., Baylor College, 1967.
Linda M. Khutho, M.D., University of Missouri, 1984.
Alex H. Kozloff, M.D., St. Louis University, 1980.
Roop Lal, M.D., Osmania Medical College, India, 1975.
Daniel K. Lane (Dermatology), M.D., Washington University, 1959.
Howard S. Lite, M.D., University of Missouri, 1983.
Roberta Loeffler, M.D., Washington University, 1984.
James F. Loomis, Jr., M.D., University of Arkansas, 1985.
Michael E. McCadden (Dermatology), M.D., Vanderbilt University, 1982.
Gerald M. Mahon, M.D., Southwestern Medical School, 1983. (See Health Key Medical Group.
Susan M. Manns-Rizzo, M.D., St. Louis University, 1984. (See Health Key Medical Group.)
David M. Margolis, M.D., University of Manitoba, 1971.
David B. Marrs (Dermatology), M.D., University of Texas Southwestern Medical School, 1978.
Jerald Maslanko, M.D., Emory University, 1975. (See Health Key Medical Group.)
Henry E. Mattis, M.D., Washington University, 1975.
Charles W. Miller (Dermatology), M.D., Washington University, 1972.
Austin F. Montgomery, M.D., University of Pittsburgh, 1954.
Arlin E. Morrison, M.D., Washington University, 1958.
Fred C. Mortensen, M.D., New York Medical College, 1953.

S. Michael Orgel, M.D., St. Louis University, 1965.
Robert F. Owen, M.D., Yale University, 1952.
Anne Pittman, M.D., St. Louis University, 1985.
Lee S. Portnoff (Dermatology), M.D., Washington University School of Medicine, 1978.
John A. Powell (Dermatology), M.D., University of Michigan, 1971.
David Prelutsky, M.D., St. Louis University, 1979.
Lisa B. Ring (Dermatology), M.D., Washington University, 1980.
Garry C. Robben, M.D., St. Louis University, 1962.
Kenneth J. Rybicki, M.D., Ph.D., University of Texas, Southwestern Medical School, 1987.
Lawrence E. Samuels (Dermatology), M.D., Washington University, 1976.
Guadalupe Sanchez (Dermatology), Ph.D., Duke University, 1980; M.D., 1980.
James A. Schiro, (Dermatology), M.D., Washington University, 1986.
Susan B. Schneider, M.D., Yale University, 1977.
John S. Schoentag (Dermatology), M.D., Washington University, 1960.
Kenneth E. Shafer, M.D., St. Louis University, 1979.

John B. Shapleigh II, M.D., Washington University, 1946.
Gerald S. Shatz, M.D., Washington University, 1974.
Carol M. Simmons, M.D., Washington University, 1979.
Allen D. Soffer, M.D., University of Missouri, Kansas City, 1983.
Elizabeth A. Stoddard, M.D., Washington University, 1957.
James Stokes, M.D., University of Missouri, 1984.
In-Sook Sunwoo, M.D., Woo Sok University, 1959.
Arnold S. Tepper, M.D., University of Missouri, 1970.
Wanda T. Terrell, M.D., Washington University, 1979. (See Health Key Medical Group.)
Sharon F. Tiefenbrunn (Dermatology), M.D., Washington University, 1975.
Elizabeth Tracy, M.D., Medical College of Wisconsin, 1986. (See Health Key Medical Group.)
David J. Tucker, M.D., St. Louis University, 1981.
Dolores R. Tucker (Dermatology), M.D., Washington University, 1974.
John H. Uhlemann (Dermatology), M.D., Washington University, 1971.
Oksana Volshteyn, M.D., Minsk State Medical Institute, Minsk, U.S.S.R., 1976.
Stanley G. Vriezelaar, M.D., University of Iowa, 1981.
Cassandra C. Weaver (Dermatology), M.D., Southern Illinois University, 1983.
Leonard B. Weinstock, M.D., University of Rochester, 1981.
Peter Weiss, M.D., Case Western Reserve University, 1980.
James R. Wiant, M.D., Jefferson Medical College, 1959.
R. Jerome Williams, Jr., M.D., Duke University, 1977. (Also Health Service.)
Wendell Williams, M.D., Baylor College, 1982.
Rudolph E. Willis, M.D., Washington University, 1977.
Karen Winters, M.D., Southern Illinois University, Carbondale, 1983.
Edward M. Wolfe (Dermatology), M.D., Washington University, 1960.
Robert E. Ziegler (Dermatology), Ph.D., Duke University, 1980; M.D., 1986.
Frank L. Zwemer, Jr., M.D., University of Southern California, 1983.

Research Associates
Charlene A. Abrams, M.S., Weizmann Institute of Science, 1985.
Coleen Sue Bosch, Ph.D., Washington University, 1988.
Kevin Caldwell, Ph.D., University of Colorado Health Science Center, 1988.
Svetlana G. Elberg, M.S., University of Kharkov, 1959.
Michael Engle, Ph.D., St. Louis University, 1976.

Jane Lewis Finch, B.S., Central Missouri State University, 1971.
Walter T. Gregory, B.S., St. Louis University, 1960.
Zianlin Han, Ph.D., Washington University, 1990.
Pilar Herrero, M.S., Vanderbilt University, 1984.
Xi-Lang Li, Ph.D., Shanghai Institute of Plant Physiology Academia Sinica, China, 1966.
Patricia M. McKevitt, M.S.W., Washington University, 1969.
Daniel Martin, M.S., University of Missouri, St. Louis, 1985.
Ann Pawlikowska-Haddal, M.D., Ph.D., Medical Academy of Todz, Poland, 1989.
Gabriella Ryan, Ph.D., University of Maryland, 1990.
Paul A. Schoening, M.S., University of Minnesota, 1986.
Alan D. Waggoner, B.A., University of Missouri, St. Louis, 1984.
Carol A. Weerts, M.A., Webster College, 1980.

Katie Hering-Smith, M.S., Southern Illinois University, 1989.
Thomas Howard, Sr.
Barry L. Marmer (Dermatology), B.S., University of Cincinnati, 1971.
Dale F. Osborne, B.S., Louisiana State University, 1971.
Betty F. Perry, A.B., Washington University, 1945.
Chyong-Shwu Su, Ph.D., George State University, 1990.
Liezhen Wang, M.D., An Hui University, China, 1982.

Assistants (Clinical)
William D. Birenbaum, M.D., University of Missouri, 1983.
Rod E. Hartzel, M.D., Northwestern University, 1985.
Raymond J. Hu, M.D., University of Missouri, 1982.
Richard G. Mrad, M.D., St. Louis University, 1985.
John E. Mullins, M.D., Washington University, 1958.
John H. Rice, M.D., University of Missouri, 1980. (See Health Key Medical Group.)
Carol A. Robinson, M.D., University of Missouri, 1985. (See Health Key Medical Group.)
Nancy J. Williams, M.D., University of Kansas, 1987. (See Health Key Medical Group.)
EDWARD MALLINCKRODT
DEPARTMENT OF
MOLECULAR BIOLOGY
AND PHARMACOLOGY
MOLECULAR BIOLOGY AND PHARMACOLOGY

Medical pharmacology is taught as part of the second-year curriculum of medical school. This course elaborates essential concepts in selective toxicity, drug metabolism, and mechanism of action. Detailed mechanisms of drug action in the treatment of a variety of pathological conditions from infection and neoplasia to the regulation of cardiovascular and neurological function are described.

Research in the department emphasizes application of the tools of genetics, molecular and cell biology and bio-organic chemistry to define mechanisms that regulate gene expression, cellular metabolism and differentiation, and to devise ways of modulating these processes in vivo. Students participate with the staff in weekly discussions of recent papers in the literature as well as their own work and that of their colleagues.

SECOND YEAR

Bio 507, 508. Pharmacology

It is the purpose of the pharmacology course, through discussions of existing drugs, to develop general principles which will be applicable as well to drugs of the future. Pharmacology draws heavily on biochemistry, physiology, and microbiology for an understanding of drug action. It looks toward pathology, medicine, and surgery for its uses.

A selection of mini-courses (Special Topics), dealing in depth with more advanced concepts of pharmacology and related topics, is integrated into the medical pharmacology course. Small groups of students regularly meet with the faculty to review and discuss the details and interpretation of original literature articles.

(a) Lectures, conferences, panel discussions.
(b) Laboratory course. Credit 7 units for the year.

Dr. Covey and Staff

RESEARCH

Bio 590.

The facilities of the research laboratories are available to those who wish to carry on an original investigation on problems of their own or on those the department is prepared to suggest.

Expression of placental and pituitary peptide hormone genes. Dr. Boime

Experimental analysis of mechanisms of arrhythmia; electrophysiology; membrane chemistry, and autonomic neural effects. Dr. Gorr

Preparation and biochemical characterization of mechanism-based inhibitors of steroid biosynthesis; development of anticonvulsant drugs. Dr. Covey

The molecular mechanism of volatile anesthetic action studied both biochemically and by NMR spectroscopy. Dr. Evers

Neurochemistry of seizures; neuropharmacology of anticonvulsant and other neurotropic drugs. Dr. Ferrendelli

Analysis of cell-specific and region-specific gene expression in the developing and adult intestine using transgenic mice; biosynthesis and compartmentalization of gut proteins; genetic and biochemical analysis of protein N-myristoylation. Dr. Gordon

Recombinant DNA-site specific mutagenesis and protein chemistry studies of the structure-function relationships in polypeptide neurotoxins which interact with acetylcholine receptors. Dr. Grant

Role of peptide hormones in cardiovascular, fluid and electrolyte homeostasis. Dr. Greendale

Molecular regulation of phospholipases involved in signal transduction. Dr. Gross

The regulation of leukotriene biosynthesis and the role of mast cells in inflammation. Dr. Jakubek

Biology of nerve growth factor; neural development and regulation; mechanism(s) of cell death. Dr. Johnson

Mechanism of insulin action; control of protein phosphorylation. Dr. Lawrence

Role of lipid mediators and polyunsaturated fatty acids in inflammation and organ immunogenicity. Dr. Lefkowitz

Neurochemistry; regulation of metabolism; quantitative histochemistry; the chemistry of individual human muscle fibers; metabolism of human ov. Dr. Lowry
Metabolic “reflections” of neuronal activity among brain regions in response to various perturbations. 
Dr. McDougal

Molecular basis of recognition of drugs using NMR, analog synthesis, and computer modeling. 
Dr. Marshall

Synthesis, assembly, and function of synaptic proteins. Dr. Mertie

Regulation and synthesis of renal transport proteins and their interactions with membrane lipids. 
Dr. Morrison

Identification and pharmacological manipulation of intrinsic mediators. Dr. Needleman

Regulation and modulation of ion channels by intracellular “second” messengers: design and characterization of photolabile intracellular probes. 
Dr. Nernstie

The in vivo and in vitro actions of fibroblast growth factors and their receptors in transgenic mice and embryonic stem cells. FGF-responsive cell lines to identify novel genes that are regulated by FGF. 
Dr. Ornitz

Study of eicosanoid metabolism of keratinocytes and fibroblasts in normal and UVB-irradiated skin. 
Dr. Pentland

Characterization of the neuroendocrine cellular system. Dr. Robb

Biology of cytotoxic lymphocytes and mechanisms of immune damage. Dr. Russell

Receptor cell biology: intracellular pathways of ligands and receptors. Dr. Schwartz

**ELECTIVES**

Descriptions of the following courses are shown in the Division of Biology and Biomedical Sciences:

**Bio 509, 510. Current Topics in Pharmacology**

**Bio 5461. Molecular Recognition**

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.
Faculty

Alumni Professor and Head of Department
Jeffrey I. Gordon, M.D., The University of Chicago, 1973. (See Department of Medicine.)

Distinguished Professor Emeritus
Oliver H. Lowry, M.D., Ph.D., The University of Chicago, 1937.

Professor Emeritus
F. Edmund Hunter, Jr., M.D., University of Rochester, 1941.

Professors
Irving Boime, Ph.D., Washington University, 1970. (See Department of Obstetrics and Gynecology.)
Peter B. Corr, Ph.D., Georgetown University, 1975. (See Department of Medicine.)
Douglas F. Covey, Ph.D., The Johns Hopkins University, 1973.
James A. Ferrendelli, M.D., University of Colorado, 1962. (See Departments of Neurology and Neurological Surgery and Ophthalmology and Visual Sciences.)
Richard W. Gross, M.D., New York University, 1976; Ph.D., Washington University, 1982. (See Department of Medicine.)
Eugene M. Johnson, Jr., Ph.D., University of Maryland, 1970.
David M. Kipnis, M.D., University of Maryland, 1951. (See Department of Medicine.)
David B. McDougal, Jr., M.D., The University of Chicago, 1947.
Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Biochemistry and Molecular Biophysics and Institute for Biomedical Computing.)

Aubrey R. Morrison (Burroughs Wellcome Clinical Pharmacology Scholar), M.B., B.S., University of London, 1970. (See Department of Medicine.)
Alan L. Schwartz, Ph.D., Case Western Reserve, 1974; M.D., 1976. (See Department of Pediatrics.)

Research Professor
Philip Needleman, Ph.D., University of Maryland, 1964.

Adjunct Professor
George W. Gokel, Ph.D., University of Southern California, 1971.

Associate Professors
Gregory A. Grant, Ph.D., University of Wisconsin, 1975. (See Department of Medicine.)
John C. Lawrence, Jr., Ph.D., University of Virginia, 1978.
Jeanne M. Nerbonne, Ph.D., Georgetown University, 1978.

Research Associate Professor

Assistant Professors
Alex S. Evers, M.D., New York University, 1978. (See Department of Anesthesiology.)
James E. Greenwald, Ph.D., Ohio State University, 1980; M.D., 1983. (See Department of Medicine.)
James B. Lefkowith, M.D., The Johns Hopkins University, 1979. (See Department of Medicine.)
Alice Pentland, M.D., University of Michigan, 1978. (See Department of Medicine.)
Kevin A. Roth, M.D., Ph.D., Stanford University, 1985. (See Department of Pathology.)

Adjunct Assistant Professors
Edward H. Blaine, Ph.D., University of Missouri, 1970.
Pamela T. Manning, Ph.D., Ohio State University, 1980.
DEPARTMENT OF
MOLECULAR
MICROBIOLOGY
MOLECULAR MICROBIOLOGY

The Department of Molecular Microbiology teaches introductory courses in microbiology and pathogenic microorganisms for first-year medical students and graduate students. The course in medical microbiology is taught in collaboration with the Division of Infectious Diseases of the Department of Medicine. The Department also offers a number of advanced courses, primarily designed for graduate students, but open to medical students. Advanced elective research activities are offered by faculty in the Department.

FIRST YEAR

Microbiology

The Microbiology course is given in the second semester of the first year and combines topics in general medical microbiology and microbial pathogenesis. The first half of the course focuses on bacterial structure, physiology, and genetics, including lectures on the mechanisms of antibiotic action and resistance. The second half of the course is centered around mechanisms of virulence, using bacteria as models to describe pathogen-host interactions in molecular detail. Additional sessions discuss the molecular biology and pathogenic importance of viruses, fungi, protozoa, and helminths. A set of laboratory exercises introduces the student to basic microbiological techniques and principles of diagnostic bacteriology.

RESEARCH

Bio 590.

These electives acquaint the student with the analyses that are used in present-day biomedical research, especially at the molecular level. Staff

Molecular biology and structural organization of bacterial cell surface fimbriae and the development of fimbrial vaccines against bacterial infections.

Dr. Abramani


Dr. Apirion

Autoimmunity with an emphasis on the complement system and immune complex processing: functional, genetic, biochemical and molecular approaches.

Dr. Atkinson

Transposable elements in bacteria. Genome organization in E. coli and Helicobacter pylori gene function. PCR-based epidemiology.

Dr. Berg

Mechanisms and control of phagocytic function, with particular emphasis on signal transduction from integrins during adhesion and phagocytosis.

Dr. Brown

Genetics of Streptococcus pyogenes and other gram-positive bacterial pathogens. Biology of conjugative transposons. Pathophysiology of infections caused by gram-positive bacteria.

Dr. Caparon

Structure, organization, and regulation of MHC genes. Molecular and cellular biology of interleukin-1.

Dr. Chaplin

Genetics and molecular biology of Mycobacterium leprae and Mycobacterium tuberculosis.

Dr. Clarke-Curtiss

Regulation of complement and acute phase protein gene expression, pulmonary immunology, inflammation.

Dr. Colten


Dr. Fleischman

Regulatory effects of the Kupffer cell of the liver on the local and systemic immune response.

Dr. Flye

Biochemistry and biology of varicella-zoster virus.

Dr. Gelb

Cellular biochemistry of malaria and parasitic helminths.

Dr. Goldberg

Enzymology of connective tissue remodeling.

Dr. Goldberg

Molecular basis of pathogenicity of Histoplasma capsulatum and Bordetella pertussis. In vitro models of respiratory tract infections and toxin effects.

Dr. Goldman

Biochemical analysis and genetic manipulation of virulence-related phenotypes.

Dr. Goldman
Idiotypic expression and immunity to Haemophilus influenzae type b and meningococcal B polysaccharides. Dr. Granoff

Molecular biology of Salmonella-macrophage interactions. Mechanisms of bacterial resistance to host microbicidal peptides. Genetic engineering with transposable elements. Dr. Groisman


Fine molecular details of chaperone-assisted pilus biogenesis in uropathogenic E. coli. Post-secretional protein folding and assembly. Dr. Hultgren

Biochemistry and genetics of macromolecule regulation: mRNA metabolism in bacteria. Dr. Karnell

Histoplasmosis: host-parasite interaction and therapeutic strategies. Dr. Kobayashi

Molecular genetics of cell growth and differentiation in normal and malignant lymphocytes. Dr. Korsmeyer

Molecular biology of the receptors for IgG. Role of bovine IgG in infant colic. Autoimmunity. Dr. Kulczycki

Latency and molecular genetics of herpes simplex virus. Dr. Leib

Differentiation and function of mononuclear phagocytes. Dr. Lin

Macrophage effector functions and host defenses against fungal infections. Adjuvants and cytokines as immune modulators. Dr. Little

Molecular genetics of lymphocyte specific genes using transfection and transgenic mice. Dr. Lob

Outer membrane proteins and pili in pathogenesis and immunity to Haemophilus influenzae. Dr. Munson

Molecular mechanisms of bacterial attachment and bacterial sensing of the environment. Dr. Normark

Herpes simplex virus (HSV) DNA replication and the interaction of HSV with neuronal cells at the molecular level. Dr. Olivo

Cellular immunology: immediate hypersensitivity immunogenetics. Dr. Parker

The role of cytokines in immunoregulation of G1 and liver in humans and mice including transgenic mouse models of disease. Dr. Peters

Studies of the mechanisms of primary immunodeficiency diseases in man. Dr. Polmar

Structure and function of human retroviruses, including HTLV-I, a cause of leukemia, and HIV, the cause of AIDS. The major focus is in studying the regulation of virus infectivity, replication, assembly, tissue tropism, and pathogenicity. Dr. Ratner

Molecular genetics of animal RNA viruses (alphaviruses and flaviviruses such as yellow fever virus and hepatitis C virus): replication, packaging, and virulence vaccine and antiviral therapeutic strategies. Dr. Rice

Mechanisms employed by the intracellular pathogens Leishmania and Mycobacteria to survive in and exploit the potentially hostile environment within host phagocytes. Dr. Russell

Interactions between RNA animal viruses and their host cells. Emphasis on maturation and assembly of viral proteins. Development of specific antiviral reagents. Dr. M. Schlessinger

Structure and replication of enveloped RNA animal viruses. Dr. S. Schlesinger

Mapping of X chromosome; functions of nontranscribed DNA; nucleolar structure. Dr. D. Schlesinger

Biochemistry, molecular and cellular biology and physiology of cytokines and their receptors, especially interferon-gamma and tumor necrosis factor. Dr. Schreiber

Antibody response to polysaccharide antigens in children. Genetic analysis of antibody repertoire. Dr. Shackelford

Transcriptional and post-transcriptional control of gene expression in African trypanosomes. Dr. Sherman

Novel adaptations for intracellular parasitism by Toxoplasma including: cell motility and invasion, regulated secretion, and avoidance of host-cell endocytic processing. Development of molecular genetic methods for analysis of drug resistance and virulence determinants in Toxoplasma. Dr. Sibley
Understanding *E. histolytica* pathogenesis at the molecular level. Dr. Stanley

The control of lymphocyte activation by protein tyrosine phosphorylation. Dr. Thomas

Protective immunity and immunodiagnosis of parasitic helminth infections. Dr. Weil

Molecular immunology studies which include: 1) immune deficiencies; 2) gene regulation; and 3) receptor biology. Dr. Wetsel

**ELECTIVES**

At present the primary enrollees in these courses are students working for a Ph.D. degree in one of the basic sciences. However, these courses are recommended for interested medical students, especially those who may be considering a career in medical research. Emphasis is placed on the organization and function of living systems at the molecular level. The courses combine formal lectures with student-directed seminars. Those courses most relevant to the field of microbiology are listed under the Division of Biology and Biomedical Sciences.

**Bio 5221. Molecular Basis of Microbial Pathogenesis**

Primarily for graduate and MSTP students, this seminar course involves discussion of current research on pathogenic microorganisms and their virulence determinants. Emphasis on new research strategies for studying the molecular mechanisms of pathogenesis and the factors controlling host-pathogen interactions. One and one half class hours per week, 1 unit credit. Dr. Goldman

**Bio 539. Topics in Animal Virology: The Molecular Biology of Animal and Plant Viral Diseases**

RNA and DNA virus replication, shutoff of host protein biosynthesis, interferon, retroviruses with emphasis on chronic diseases (i.e., visna, AIDS). Defective viruses (i.e., satellite RNA of tobacco ring spot virus, hepatitis delta virus), viruses as vectors and their possible role in preventing disease. Course consists of lectures and discussions of original papers. Credit 3 units. Drs. M. Schlesinger, S. Schlesinger, C. Rice

**Bio 5392. Molecular Microbiology and Pathogenesis**

First half of this course focuses on prokaryotic physiology and genetics, with special attention to recent discoveries in gene regulation and protein processing. Second half is devoted to microorganisms that cause disease, with emphasis on the molecular interactions between pathogen and host. Lecture-based course with weekly discussions of primary research literature. 3 class hours per week, 3 units credit. Drs. Goldman, Munson

**Note**—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.
Molecular Microbiology

Faculty

Professor and Head of Department


Professors

David Apirion, Ph.D., University of Glasgow, 1963.

John P. Atkinson, M.D., Kansas University, 1969. (See Department of Medicine.)

David E. Berg, Ph.D., University of Washington, 1969. (See Department of Cell Biology and Physiology and Medicine.)

Harvey R. Cohen, M.D., Western Reserve University, 1963. (See Department of Pediatrics.)

Susan E. Cullen, Ph.D., Albert Einstein College of Medicine, 1971. (See Department of Genetics.)

M. Wayne Flye, M.D., University of North Carolina, 1967; Ph.D., Duke University, 1980; M.A. (hon.), Yale University, 1985. (See Department of Surgery.)

David E. Kennell, Ph.D., University of California, 1959.

George S. Kobayashi, Ph.D., Tulane University, 1963. (See Department of Medicine.)

J. Russell Little, Jr., M.D., University of Rochester, 1956. (See Department of Medicine.) (Jewish Hospital)

Gerald Medoff, M.D., Washington University, 1962. (See Department of Medicine.)

Charles W. Parker, M.D., Washington University, 1953. (See Department of Medicine.)

Stephen H. Polmar, Ph.D., Union College, 1966; M.D., Case Western Reserve University, 1967. (See Department of Pediatrics.)

Milton J. Schlesinger, Ph.D., University of Michigan, 1959.

David Schlessinger, Ph.D., Harvard University, 1961. (See Departments of Genetics and Medicine.)

Robert D. Schreiber, Ph.D., State University of New York, 1973. (See Department of Pathology.)

Adjunct Professor

Joseph M. Davies, Ph.D., Indiana University, 1966; M.D., Washington University, 1968.

Associate Professors

Eric J. Brown, M.D., Harvard University, 1975. (See Departments of Cell Biology and Physiology and Medicine.)

Julian B. Fleischman, Ph.D., Harvard University, 1960.

Lawrence D. Gelb, M.D., Harvard University, 1967. (See Department of Medicine.)

William E. Goldman, Ph.D., University of North Carolina, 1980.

Dan M. Granoff, M.D., The Johns Hopkins University, 1968. (See Department of Pediatrics.)

Henry V. Huang, Ph.D., California Institute of Technology, 1977.

Stanley J. Korsmeyer, M.D., University of Illinois, 1976. (See Department of Medicine.)

Anthony Kulczycki, Jr., M.D., Harvard University, 1970. (See Department of Medicine.)

Hsin-san Lin, M.D., National Taiwan University, 1960; Ph.D., The University of Chicago, 1968. (See Department of Radiology.)

Robert S. Munson, Ph.D., University of Connecticut, 1976. (See Department of Pediatrics.)

Charles M. Rice, Ph.D., California Institute of Technology, 1981.


Penelope G. Shackelford, M.D., Washington University, 1968. (See Department of Pediatrics.)

Adjunct Associate Professor

Martin I. Bryant, Ph.D., University of Southern California, 1977; M.D., 1982.

Assistant Professors

Soman N. Abraham, Ph.D., University of Newcastle Upon Tyne, England, 1981. (See Department of Pathology.)

Penelope G. Shackelford, M.D.
Michael G. Caparon, Ph.D., University of Iowa, 1985.

L. David Sibley, Ph.D., Louisiana State University, 1985. (See Department of Molecular Microbiology.)

David D. Chaplin, Ph.D., Washington University, 1980; M.D., 1980. (See Department of Medicine.)

Daniel E. Goldberg, M.D., Ph.D., Washington University, 1985. (See Department of Medicine.)

Scott J. Hultgren, Ph.D., Northwestern University, 1987.

David A. Leib, Ph.D., University of Liverpool, 1986. (See Department of Ophthalmology and Visual Sciences.)

Dennis Y. Loh, M.D., Harvard University, 1977. (See Departments of Genetics and Medicine.)

Paul David Olivo, M.D., University of Florida, 1981; Ph.D., 1982. (See Department of Medicine.)

Marion G. Peters, M.B.B.S., Melbourne University, 1972. (See Department of Medicine.)

Lee Ratner, M.D., Ph.D., Yale University, 1979. (See Department of Medicine.)

Samuel L. Stanley, M.D., Harvard University, 1980. (See Department of Medicine.)

Matthew L. Thomas, Ph.D., University of Utah, 1981. (See Department of Pathology.)

Gary J. Weil, M.D., Harvard University, 1975. (See Department of Medicine.)

Rick A. Wetsel, Ph.D., University of Texas, 1982. (See Department of Pediatrics.)

Herbert W. Virgin, M.D., Ph.D., Harvard University, 1985.

### Research Assistant Professors

Josephine E. Clark-Curtiss, Ph.D., Medical College of Georgia, 1974.

Gregory I. Goldberg, Ph.D., Weizmann Institute of Science, 1977. (See Department of Medicine.)


David R. Sherman, Ph.D., Vanderbilt University, 1987.

### Instructors

Thomas J. Chambers, M.D., Harvard University, 1982.

Ramdaswamy Chandrashekar, Ph.D., University of Bombay, 1986.

Linda G. Eisenberg, Ph.D., University of North Carolina, 1982.

Per Falk, M.D., University of Gothenberg, 1986; Ph.D., 1991.

### Research Instructors

Nancy C. Collier, Ph.D., University of Texas, 1982.


### Research Assistant

Richard J. McDonald
DEPARTMENT OF NEUROLOGY AND NEUROLOGICAL SURGERY
NEUROLOGY AND NEUROLOGICAL SURGERY

Neurology and Neurological Surgery concern themselves with the diseases of brain, spinal cord, peripheral nerves, and muscles. An introduction to the anatomy and physiology of the nervous system is presented in the first-year course in neural sciences directed by the Department of Anatomy and Neurobiology, with participation of faculty from Neurology and Neurological Surgery. In the second year, the Department of Neurology and Neurological Surgery presents the course in Pathophysiology of Nervous System Disorders. The course emphasizes how knowledge derived from basic or clinical investigations leads to improvements in clinical care. The department also participates in the Preparation for Clinical Medicine course, providing lectures, demonstrations and teaching exercises with patients in neurological physical diagnosis. A full-time, four-week clerkship in the third year, with collaborative teaching by both Neurology and Neurological Surgery services, introduces students to the clinical care of patients with diseases of the nervous system. Questions pertaining to neurorehabilitation and ethical issues in management of neurological problems are addressed. In the fourth year, there are opportunities for many varieties of advanced clinical or research experience.

Several divisions exist within Neurology and Neurological Surgery:

James L. O'Leary Division of Experimental Neurology and Neurological Surgery: Dr. Woolsey (Director), Dr. McGaskland

Division of Neuropsychology: Dr. Petersen (Acting Director), Drs. Corbetta, Shulman, Miezin, Deuel

Division of Pediatric Neurology: Dr. Dodge (Acting Director), Drs. Deuel, Dodson, Neid, Noetzel, Prensky, Rothman, Thurston, Yamada

Division of Pediatric Neurosurgery: Drs. Park, Kaufman

In addition, several groups of faculty members are established for specialized research and teaching purposes. They include:

Center for the Study of Nervous System Injury: Dr. Choi (Director), Drs. Carpenter, Larson, Perlmutter, Powers, Snyder, Tempel, Videen, Petersen, Miezin, Shulman

Movement Disorders Section: Dr. Perlmutter (Director), Drs. Hunt, Landau, Sabrman, Schiebenn, Tempel, Thach

Neurocritical Care: (Director to be named), Drs. Choi, Dacey, Powers

Neurorehabilitation: Dr. Thack (Director), Noetzel, Schiebenn

Areas of Neurosurgical specialization include:

Epilepsy Surgery, Drs. Goldring, Bernardi, Silberfeld
Cranial Base Surgery, Dr. Gribb
Pituitary Surgery, Dr. Coxe
Neuro- oncology, Drs. Dacey, Rich
Pediatric Neurosurgery, Drs. Coxe, Park, Kaufman
Cerebrovascular Surgery, Drs. Dacey, Gribb, Rich
Spinal Neurosurgery, Dr. Vollmer

SECOND YEAR

Neurological Pathophysiology and Introduction to Clinical Neurology and Neurological Surgery

Lectures, demonstrations, and case conferences covering disease mechanisms. Dr. Pearlman and Neurology-Neurosurgery Staff

Neurological Examination in Clinical Diagnosis

(Part of interdepartmental course in clinical diagnosis)

Lectures, demonstrations, and practice examinations of neurological patients. Dr. Pearlman and Staff

THIRD YEAR

Combined Neurology-Neurosurgical Clerkship

A full-time, four-week clerkship is provided on the neurology service at Barnes and St. Louis Regional Medical Center, and on the Barnes Hospital neurosurgical service. Patients are assigned to students who follow them with the resident staff and discuss them regularly in conferences with the senior neurological and neurosurgical staff. Students also work in the neurology and neurosurgical clinics under staff supervision. Drs. Choi, Dacey, and Staff
FOURTH YEAR ELECTIVES

Research
A six- to twelve-week elective is available in many areas such as neuroanatomy, neurophysiology, cerebral metabolism and circulation, neurochemistry, neuropharmacology, etc. Facilities are available for qualified students in any year to undertake original research in the laboratories of the department or in the clinics and wards. Drs. Dacey, Choi, and Staff

Clinical Neurosurgery
The goal of the six-week clerkship at Barnes Hospital is to provide an overview of neurological surgery. Responsibilities include patient workup, pre- and post-operative care, and attendance at selected neurosurgical operations. Daily teaching rounds are held with a member of the attending staff. Students also work in the Neurosurgical Clinic and attend the weekly staff conferences. Dr. Dacey and Staff

Consult Neurology/Aging and Dementia
One Subinternship is available at Barnes and one at St. Louis Regional Medical Center. Both have assignments similar to those of interns while meeting the legal restrictions of the State of Missouri. The Consult elective at Barnes Hospital involves close collaboration with the consult resident and senior staff. An elective in the clinical aspects of aging and dementia focuses on the clinical assessment and practical management of the elderly patient. Drs. Choit, Clifford, Morris and Staff

Staff Conferences
Students are invited to attend the Conjoint Neurological Conference (neuropathology, neuroradiology, medical neurology, pediatric neurology, and neurological surgery) held on Wednesday at 3:30 p.m. in the West Pavilion Auditorium. The format of the conference includes clinical presentations, symposia, and CPCs. Neurosurgery Grand Rounds are held weekly at 7:15 a.m. on Wednesday in the Neurosurgery conference room, second floor, McMillan Hospital. Case Management Conference is held every Monday at 5:00 p.m. in Scarbellino Auditorium. Professor’s rounds in Neurosurgery are held at 8:00 a.m. on Saturday in 506 McMillan. Professor’s rounds in Neurology are held at 12:00 noon on Thursday on Barnes 11400.
Faculty
Co-Heads of Department
Dennis W. Choi,
Ralph G. Dacey, Jr.

NEUROLOGY
Andrew B. and Gretchen P.
Jones Professor of Neurology and Head
Dennis W. Choi, M.D., Ph.D.,
Harvard University, 1978.

Seay Professor of Clinical
Neuropharmacology
James A. Ferrendelli, M.D.,
University of Colorado, 1962. (See
Departments of Pharmacology and
Ophthalmology and Visual
Sciences, and Neurological
Surgery.)

Allen P. and Josephine B. Green
Professor of Pediatric
Neurology
Arthur L. Prensky, M.D.,
New York University, 1955. (See
Department of Pediatrics.)

Ernest and Jane G. Stein
Professor of Development
Neurology
Steven M. Rothman, M.D.,
State University of New York, Upstate,
1973. (See Departments of
Anatomy and Neurobiology and
Pediatrics.)

August A. Busch, Jr., Professor
Emeritus of Neurological
Surgery and Lecturer
Henry G. Schwartz, M.D., The
Johns Hopkins University, 1932.

Professors Emeriti
Sven G. Eliasson, Ph.D., Universi-
Jean H. Thurston (Neurochemis-
try), M.D., University of Alberta,
1941. (See Department of
Pediatrics.)

Harish C. Agrawal (Neurochemis-
try), Ph.D., Allahabad University,
1964. (See Departments of
Pathology and Pediatrics.)

Leonard Berg, M.D., Washington
University, 1949.

Ruthmary K. Deuel, M.D.,
Columbia College of Physicians
and Surgeons, 1961. (See Depart-
ment of Pediatrics.)

Philip R. Dodge, M.D., University
of Rochester, 1948. (See Depart-
ment of Pediatrics.)

W. Edwin Dodson, M.D., Duke
University, 1967. (See Department of
Pediatrics.)

Carlton C. Hunt (Neuropyscho-
logy), M.D., Cornell University,
1942. (See Department of Cell
Biology and Physiology and
Neurological Surgery.)

William M. Landau, M.D.,
Washington University, 1947.

Alan L. Pearlman, M.D.,
Washington University, 1961. (See
Department of Cell Biology and
Physiology.)

Alan Pestronk, M.D., The Johns
Hopkins University, 1970.

Marcus E. Raichle, M.D.,
University of Washington, 1964.
(See Department of Radiology.)
(Also School of Engineering and
Applied Science)

Martha Storandt (Psychology),
Ph.D., Washington University,
1966. (Also Department of
Psychology)

W. Thomas Thach, Jr., M.D.,
Harvard University, 1964. (See
Departments of Anatomy and
Neurobiology and TWJ.)

Thomas A. Woolsey (Neuro-
sience), M.D., The Johns Hopkins
University, 1969. (George H. and
Ethel R. Bishop Scholar in
Neuroscience in Neurology and
Neurological Surgery.) (See
Neurological Surgery and Depart-
ments of Anatomy and Neurobiol-
ogy, and Cell Biology and
Physiology.)

Research Professor
Kenneth B. Larson (Biomedical
Computing), Ph.D., Massachusetts
Institute of Technology, 1964. (See
Institute for Biomedical Comput-
ing.)

Professors (Clinical)
Herbert E. Rosenbaum, M.D.,
University of Oregon, 1949.

E. Robert Schultz, M.D.,
Washington University, 1955. (See
Department of Psychiatry.)

Stuart Weiss, M.D., Washington
University, 1954.

Associate Professor Emeritus
Lawrence A. Cohen, M.D.,
Western Reserve University, 1954.

Associate Professors
David B. Clifford, M.D.,
Washington University, 1975. (St.
Louis Regional Hospital)

John C. Morris, M.D., University
of Rochester, 1974. (Jewish
Hospital) (See Department of
Pathology.)

Michael J. Noetzel, M.D., Univer-
sity of Virginia, 1977. (See
Department of Pediatrics.)

Joel S. Perlmutter, M.D.,
University of Missouri, 1979. (See
Department of Radiology.)

Steven E. Petersen
(Neuropsychology), Ph.D.,
California Institute of Technology,
1981. (See Department of Anatomy
and Neurobiology and Neurological
Surgery.)

William J. Powers, M.D., Cornell
University, 1975. (Jewish Hospital)
(See Department of Radiology.)

Shirley A. Sahrmann (Neuro-
physiology), Ph.D., Washington
University, 1973. (See Department of
Cell Biology and Physiology and
Program in Physical Therapy.)

William D. Snider, M.D., Univer-
sity of North Carolina Medical
School, 1977.

John L. Trotter, M.D., Washington
University, 1969. (Gordon R. and
Thelma B. Coates Scholar in
Neurology)
**Research Associate Professor**
Lyndon S. Hibbard (Neuroscience Imaging), Ph.D., Michigan State University, 1977. (See Institute for Biomedical Computing.)

**Associate Professors (Clinical)**
Joseph M. Dooley, Jr., M.D., St. Louis University, 1958.

**Research Scientist**
Francis Miezin, M.S., University of Wisconsin, 1972.
Gordon I. Shulman (Neuropsychology), Ph.D., University of Oregon, 1979. (See Department of Psychology.)

**Assistant Professors**
Janet M. Balota, Ph.D., University of South Carolina, 1982. (See Program in Occupational Therapy.)
Debra A. Barrett, M.D., Yale University, 1979. (See Department of Ophthalmology.)
M. Carolyn Baum, M.A., Webster College, 1979. (See Program in Occupational Therapy.)
Dorothy Anne Cross, M.D., University of Alabama, 1980.
Michael N. Diringer, M.D., University of Kentucky, 1982.
Dorothy F. Edwards, Ph.D., Washington University, 1980. (See Program in Occupational Therapy.)
John W. Miller, M.D., University of Illinois, 1977; Ph.D., 1981.
Jeffrey J. Neil, M.D., Ph.D., Washington University, 1984. (See Department of Pediatrics.)
Marc H. Schieber, M.D., Ph.D., Washington University, 1982. (See Department of Anatomy and Neurobiology.)

**Research Assistant Professors Emeriti**
Joe Iwukai (See Neurological Surgery.)
Lloyd N. Simpson (See Neurological Surgery.)

**Research Assistant Professors**
Michael Chua, Ph.D., University of New South Wales, 1986.
Julaine Florence, M.H.S., Washington University, 1983.
Kathleen Mann Koepke (Psychology), Ph.D., University of North Carolina, 1983.
Emily A. Labarge, M.Ed., University of Missouri, 1980; Ed.P., 1990. (Also Department of Psychology)
James McCasland (Experimental Neurology), Ph.D., California Institute of Technology, 1983.
Tom O. Videen (Neuropsychology), Ph.D., University of Washington, 1981. (See Department of Radiology.)

**Assistant Professors (Clinical)**
Denis I. Altman, M.B., University of the Witwatersrand, 1975. (See Department of Pediatrics.)
Garrett C. Burris, M.D., University of Southwestern Louisiana, 1968. (See Department of Pediatrics.)
Richard J. Ferry, M.D., St. Louis University, 1962.
Joseph Hanaway, M.D., McGill University, 1960.
William B. Hardin, M.D., University of Texas, Galveston, 1957.
Walter Lemann, M.D., Tulane University, 1979.

Abraham Zvi Snyder, Ph.D., The Rockefeller University, 1977; M.D., State University of New York at Buffalo, 1981.
Kelvin A. Yamada, M.D., Baylor College, 1983. (See Department of Pediatrics.)

Robert P. Margolis, M.D., St. Louis University, 1975.
David F. Mendelson, M.D., Indiana University, 1948.
James R. Rohrbaugh, M.D., Ohio State University, 1974. (See Department of Pediatrics.)
Howard I. Weiss, M.D., Tulane University, 1972.

**Instructor Emeritus**

**Instructors**
Muhammad Taha Al-Iozi, M.D., King Edward Medical College, Pakistan, 1980.
Alma R. Bicknese, M.D., University of Illinois, 1965.
Anne Connolly, M.D., Indiana University, 1984.
Glen LoPate, M.D., Ohio State University, 1987.
Kun Xu, M.D., Zhongshan Medical University, 1978.
Woon Chee Yee, M.D., University of Malaysia, 1971.

**Research Instructors**
Rita Canfield, M.S.N., St. Louis University, 1979.
David A. Carpenter, M.D., Washington University, 1983.
Maurizio Corbetta, M.D., University of Pavia, 1985.
Terri L. Hosto, M.S.W., University of Michigan, 1986.
Susan Leon, M.S.N., St. Louis University, 1991.
NEUROLOGICAL SURGERY

Professor and Head
Ralph G. Dacey, Jr., M.D., University of Virginia, 1974.
August A. Busch, Jr., Professor Emeritus and Lecturer

Professors
James A. Ferrendelli, M.D., University of Colorado, 1962. (See Neurology and Departments of Pharmacology and Ophthalmology and Visual Sciences.)
Mokhtar Gado, DMRE, Cairo University, 1960. (See Department of Radiology.)
Sidney Goldring, M.D., Washington University, 1947.
Robert L. Grubb, Jr., M.D., University of North Carolina, 1965. (See Department of Radiology.)
Carlton C. Hunt, M.D., Cornell University, 1942. (See Department of Cell Biology and Physiology and Neurology.)
Tae Sung Park, M.D., Yonsei University, 1971.
Thomas A. Woolsey, The Johns Hopkins University, 1969. (Ethel R. and George H. Bishop Scholar in Neuroscience) (See Neurology and Departments of Anatomy and Neurobiology and Cell Biology and Physiology.)

Associate Professors
Keith M. Rich, M.D., Indiana University, 1977. (See Department of Anatomy and Neurobiology)
Rene Tempelhoff, M.D., University of Lyon, France, 1984. (See Department of Anesthesiology)

Assistant Professors
Debra A. Barrett, M.D., Yale University, 1979. (See Department of Ophthalmology and Neurology)
Andreas H. Burkhalter, Ph.D., University of Zurich, 1977. (See Department of Anatomy and Neurobiology.)
Bruce A. Kaufman, M.D., Case Western Reserve University, 1982
Dennis G. Vollmer, M.D., University of Texas, 1979.

Research Scientist
Gary W. Harding, M.S.E., University of Washington, 1984.

Research Assistant Professor
Jeffrey M. Gidday, Ph.D., University of Virginia, 1986.

Instructor
Isaac A. Edwards (Clinical Neurophysiology), P.A., St. Louis University, 1974.

Research Assistants
Masaaki Kimura, M.D., Nagoya University, 1983.
Karl L. Probst

Research Associate
Hans H. Dietrich, Ph.D., Ruhr University, 1986.
OBSTETRICS AND GYNECOLOGY

The student's involvement in obstetrics and gynecology consists of a thorough exposure to the basic concepts in reproductive biology and an active participation in the delivery of medical care to women with gestations normal or at risk, congenital anomalies of the pelvic viscera, structural disorders secondary to difficult childbirth, reproductive endocrinopathies and infertility, and gynecologic malignancies. The third-year clerkship is conducted at Barnes Hospital, Jewish Hospital, and St. Louis Regional Medical Center. Fourth-year electives may be taken at Barnes Hospital or in the many affiliated hospitals in St. Louis. Regularly held conferences in reproductive endocrinology, maternal-fetal medicine, OB-GYN pathology, and gynecologic oncology supplement the student's education.

SECOND YEAR

Second-year students are introduced to obstetrics and gynecology with lectures in reproductive biology which apply the pelvic anatomy and physiology taught in the first year, physiology of tubal transport and ovarian control, myometrial function, placental perfusion, steriodogenesis, genetics, and prenatal diagnosis.

THIRD YEAR

Comprehensive study of the reproductive health needs of women is the focus of the six-week curriculum. Opportunity for supervised active participation is emphasized in out-patient clinics, out-patient surgery, pre- and post-operative surgical management, routine and high risk obstetrics, and care of the infertile and oncology patient. Students are assigned to two clinical rotations at either Barnes, Jewish, or Regional Medical Center. Teaching is provided by the faculty and housestaff. Students participate in all teaching conferences offered by the department, as well as attend a core curriculum lecture series. Student assessment is based on the two clinical rotations and a written examination.

FOURTH YEAR

Fourth-year students wishing to take an externship or research elective can choose from a variety of courses:

Ob-Gyn Subinternships

(A) Endocrinology-Infertility Subinternship. In the office and hospital, the extern participates in the study and treatment of women with reproductive endocrine disorders and infertility. The extern presents patients in conferences, has assigned reading, and obtains experience in the techniques of steroid and gonadotropin quantitation as well as various manipulative procedures. Dr. Gast

(B) Pathology Subinternship. The elective elucidates the principles of anatomic pathology as applied to operative material in obstetrics and gynecology. The extern examines gross and microscopic specimens in the Ob-Gyn Pathology Laboratory and reviews pertinent literature with a senior pathologist. Dr. Gersell

(C) Gyn Oncology Subinternship. This elective concerns itself with the diagnosis and treatment of malignant tumors of the female reproductive tract. The extern is involved in all aspects of the care of women with gyn malignant tumors. This experience will include the surgical treatment, radiation therapy, and chemotherapy. Dr. Camel

(D) Maternal-Fetal Medicine Subinternship. The subintern participates in the care of women with gestations at risk (e.g., diabetes, hypertension, renal disease, hematologic abnormalities, preterm labor, etc.). Antepartum evaluation and monitoring of the pregnant woman and her fetus are emphasized. Dr. Holcomb

(E) Ob-Gyn Preceptorship. Students who participate in this preceptorship spend six weeks with a clinical faculty member who is in private practice. They accompany the physician in the office, make hospital rounds and operate with their preceptors at Barnes, Jewish, and other community hospitals. The student becomes familiar with the experiences of the private practitioner. Dr. Schreiber
(F) Obstetric Anesthesiology. In this clinical elective, students receive instruction in the fundamentals of obstetric pain relief and newborn infant management and resuscitation. The pharmacology of sedatives, tranquilizers, narcotics, local anesthetics, inhalation, and intravenous drugs is demonstrated by practical application, emphasizing maternal-fetal implications in the management of labor. Special local anesthetic blocks such as caudal, lumbar epidural, and saddle spinal. Experience is also gained in the management of general anesthesia for minor gynecologic procedures such as postpartum tubal ligations.

Anesthesia Staff

(G) Perinatal Medicine Subinternship at St. Louis Regional Medical Center. The subintern is provided with practical experiences and theoretical aspects of the high risk pregnancy, and an opportunity to explore a chosen aspect of the field in depth. The subintern will be assigned patients for initial evaluation and continuing care on the inpatient antepartum service and outpatient High Risk Clinic. The subintern will also be involved in the prenatal testing laboratory. The elective will provide experience in medical and obstetrical complications (e.g., diabetes, hypertension, renal diseases, Rh disease, tocolysis). 

Dr. Staisch

(H) OB/GYN Outpatient Care Subinternship. This experience is designed to acquaint the subintern with the diagnosis and care of outpatients. While primarily located in the Gynecology Clinic and Outpatient Surgery unit, it should provide a more general overview of how to evaluate, diagnose, and provide definitive treatment (both medical and surgical) without hospital admission. The subintern will spend 3-4 mornings weekly participating in outpatient surgery under the supervision of staff and housestaff, and 3 or 4 additional half-days in the clinic and private offices, primarily participating with attending staff. Mornings should provide an understanding of mechanisms utilized in providing surgical care to outpatients, while afternoons should introduce the student to both the style and substance of office care.

Dr. McLister

(I) Pediatric and Adolescent Gynecology Subinternship. This highly specialized elective is suggested for students who have a special interest in pediatrics or gynecology. The subintern will participate in the initial evaluation and ongoing care of the pediatric and adolescent gynecology patient. The subintern will participate in the outpatient clinic as well as the inpatient, emergency room, and operating room experiences. Topics such as menstrual disorders, congenital anomalies, and contraceptive counseling will be stressed.

Dr. Merritt

Research Electives

(A) Regulation of Placental Hormone Synthesis. The laboratory is interested in the biosynthesis and assembly of multisubunit hormones of the placenta and pituitary. These interests can be divided into two general categories: (1) elucidating the mechanism of several post-translational reactions in the assembly and secretion of newly synthesized hormonal subunits, and (2) studies on the factors governing the expression of several placental and pituitary hormone genes. The approaches to these problems involve the use of site-directed mutagenesis and transgenic animals. Students will be concerned with concepts and techniques of molecular biology as applied to the above research. Dr. Botme

(B) Spem Biochemistry and Andrology. Research is performed in sperm biochemistry, including both the study of the molecular mechanisms used by sperm to penetrate the ova and male andrology. Short-range projects could include toxicology of sperm and sperm-egg association, characterization of several acrosomal proteinases, etc. Dr. Polakoski

(C) Bio-Org nic Chemical Endocrinology. Estrogens and progesterone control of the development and function of the female reproductive system. Laboratory research is focused on the biosynthesis, transport, and mechanism of hormones with emphasis on the interactions between steroid hormones and macromolecules. New steroid hormone analogs are synthesized and tested for these studies. Also, new potential drugs for treating human ovarian cancer are synthesized and tested in vitro and in vivo. Dr. Sweet

(D) Cell Biology and Immunology. The research involves the in vitro and in vivo analysis of tumor cells with particular emphasis on the relationship between the host immune system and the growth of tumorigenic cells. Two systems are currently used to facilitate this analysis: a mouse model system in which tumorigenic cells are induced by chemical carcinogens and a human system in which tumors, derived from patients, are established as cell lines in vitro. A variety of immunological and biological techniques are utilized and the student is encouraged to participate in ongoing research as well as to understand the conceptual framework on which the research is based. Dr. Collins
Faculty

Professor and Head of Department

Professors Emeriti

Walter G. Wiest, Ph.D., University of Wisconsin, 1952.

Professors
Irving Boime, Ph.D., Washington University, 1970. (See Department of Pharmacology.)

H. Marvin Camel, M.D., Creighton University, 1950.

James P. Crane, M.D., Indiana University, 1970. (See Departments of Genetics and Radiology.)

Ernst R. Friedrich, M.D., University of Heidelberg, 1954.

Ming-Shian Kao, M.D., National Taiwan University Medical College, 1961.


Kenneth L. Polakoski, Ph.D., University of Georgia, 1972.

Ronald C. Strickler, M.D., University of Toronto, 1967.

Frederick Sweet, Ph.D., University of Alberta, 1968.

James C. Warren, M.D., University of Kansas, 1954; Ph.D., University of Nebraska, 1961. (See Department of Biochemistry and Molecular Biophysics.)

Professors Emeriti (Clinical)
A. Norman Arneson, M.D., Washington University, 1928. (See Department of Radiology.)

John E. Hobbs, M.D., Washington University, 1927.

Frank B. Long, Jr., M.D., Washington University, 1947.

William H. Masters, M.D., University of Rochester, 1943. (See Department of Psychiatry.)

Melvin A. Roblee, M.D., Washington University, 1925.

Professors (Clinical)

Associate Professor Emeritus
George J. L. Wulff, Jr., M.D., Washington University, 1933.

Associate Professors
Michael J. Gast, M.D., Ohio State University, 1975; Ph.D., Washington University, 1981.

Deborah J. Gersell, M.D., Washington University, 1975. (See Department of Pathology.)

Asko I. Kivikoski, M.D., University of Turku, 1958; D.Sc., 1967.


Jacques Sauvage, M.D., University of Liege, 1957.

Klaus J. Staisch, M.D., Free University of Berlin, 1966.

Associate Professors Emeriti (Clinical)

James Pennoyer, M.D., University of Rochester, 1939.

Norman K. Muschany, M.D., Temple University, 1951.

Associate Professors (Clinical)
S. Michael Freiman, M.D., Washington University, 1955.

Andrew E. Galakatos, M.D., University of Missouri, 1965.

J. Barlow Martin, M.D., Washington University, 1955.

Marvin Rennard, M.D., Washington University, 1952.

Lee A. Rigg, M.D., Washington University, 1971.

Melvin M. Schwartz, M.D., University of Nebraska, 1947.


Assistant Professors
Jeffrey M. Dicke, M.D., Ohio State University, 1978.

Diana L. Gray, M.D., University of Illinois, 1981.

Randall R. Odem, M.D., University of Iowa, 1981.

David G. Mutch, M.D., Washington University, 1980.

Michael J. Paul, M.D., Northwestern University, 1980.

Janet S. Rader, M.D., University of Missouri, 1983.

James S. Smeltzer, M.D., Case Western Reserve University, 1978.

Research Assistant Professors
Sau Wai Cheung, Ph.D., Indiana University, 1975.

John L. Collins, Ph.D., University of Tennessee, 1976.

Gary L. Murdock, Ph.D., Medical University of South Carolina, 1976.

Lisa M. Olson, Ph.D., University of Illinois, 1986.

James L. Thomas, Ph.D., University of Alabama, 1981.

Assistant Professors Emeriti (Clinical)
William Berman, M.D., Washington University, 1935.


Willard C. Scrivner, M.D., Washington University, 1930.

Helman C. Wasserman, M.D., Washington University, 1932.

Mitchell Yanow, M.D., Washington University, 1941.
Assistant Professors (Clinical)

Ira C. Gall, M.D., University of Cincinnati, 1951.
C. Richard Gulick, M.D., University of Rochester, 1971.
Randall L. Heller, Jr., Ph.D., University of Missouri, 1968; M.D., University of Texas, 1976.
Jacob Klein, M.D., Jefferson Medical College, 1968.
Carolyn M. Martin, M.D., Washington University, 1976.
Jorge Pineda, M.D., National University of Honduras, 1972.
Jonathan R. Reed, M.D., Meharry Medical College, 1965.
Chotchai Srisuro, M.D., Faculty of Medical Sciences, 1967.
M. Bryant Thompson, M.D., University of California, 1961.
Albro C. Tobey, M.D., Trinity College, University of Dublin, 1972.
J. Leslie Walker, M.D., University of Tennessee, 1960.

Instructor Emeritus


Instructors

Lisa M. Bernhard, M.D., Louisiana State University, 1985.
Jane E. Corteville, M.D., Washington University, 1983.
Catherine L. Dean, M.D., University of Missouri, Kansas City, 1983.
Jonathan G. Erich, M.D., Loma Linda University, 1982.
Mazilu M. Havens, R.D.M.S.
William L. Holcomb, Jr., M.D., Indiana University, 1975.
Rebecca P. McAllister, M.D., University of Kentucky, 1979.
Diane F. Merritt, M.D., New York University, 1976.
Donna L. O'Shea, M.D., University of Rochester, 1980.
Nanette K. Rumsey, M.D., Northwestern University, 1985.
Jaye M. Shyken, M.D., University of Missouri, 1980.
Daniel B. Williams, M.D., University of Missouri, Kansas City, 1985.

Instructors (Clinical)
John K. Appelbaum, M.D., Washington University, 1984 (See Health Key Medical Group.)
Joe E. Belcher, M.D., St. Louis University, 1957.
Joseph C. Boveri, M.D., St. Louis University, 1959.
Craig W. Boyd, M.D., University of Illinois, Peoria, 1983.
Christine M. Cernik, M.D., Rush University, 1983.
Shih-Chung Chang, M.D., Chung-Shan Medical College, 1968.
Ronald J. Chod, M.D., University of Texas, Dallas, 1983.
David E. Dugger, M.D., Vanderbilt University, 1976.
Cathleen R. Faris, M.D., University of Kansas, 1982.
Joseph Hazan, M.D., Ege University Medical School, 1971.

Godofredo M. Herzog, M.D., Washington University, 1957.
William E. Houck, M.D., University of Cincinnati, 1981.
Laura R. Hulbert, M.D., Washington University, 1981.
Michael K. Johnson, M.D., St. Louis University, 1975.
Vernon L. Johnson, M.D., St. Louis University, 1985.
Mark J. Jostes, M.D., University of Missouri, 1981.
Justin F. Kramer, M.D., University of Michigan, 1949.
Theodore M. Meiners, M.D., Washington University, 1948.
Sam Momtazee, M.D., Shiraz Medical School, 1961.
Alvaro Mora, M.D., Antioquia University.
Gerald Newport, M.D., Washington University, 1953.
Louis T. Riley, M.D., University of Kentucky, 1980.
Chinda Rojanasathit, M.D., Siriraj Medical School, 1967.

Jerome D. Sachar, M.D., University of Missouri, 1979.
Kevin B. Schaberg, M.D., Washington University, 1966.
Daniel J. Semenoff, M.D., St. Louis University, 1963.
John A. Stopple, M.D., University of Wisconsin, 1969.
Gary M. Wasserman, M.D., University of Missouri, Kansas City, 1980.
Mark S. Wasserman, M.D., University of Missouri, Kansas City, 1984.
David L. Weinstein, M.D., St. Louis University, 1985.
Parker H. Word, M.D., Howard Medical School, 1944.

Research Instructors
Rita Basuray, Ph.D., University of Illinois, 1983.
Roger D. Johnson, Ph.D., University of Tennessee, 1990.
Li Sun, M.D., Norman Bethune University, 1984.

Research Instructor (Adjunct)
Robert F. Palank, Ph.D., St. Louis University, 1985.
OPHTHALMOLOGY AND VISUAL SCIENCES

Instruction begins in the second year with examination of the eye and a series of lectures on various aspects of ocular disease. During the third year, students are assigned to an ophthalmology clerkship for one week. In the fourth year, six-week and twelve-week clinical or research electives are offered.

SECOND YEAR

Introduction to clinical ophthalmology begins in the second year with a lecture and practicum (peer exam) on taking an ocular history and performing an ocular exam. Emphasis is on the use of the ophthalmoscope. Additionally, during the second year, there is a series of lectures on various aspects of ocular disease. The emphasis is on ocular manifestations of common systemic diseases, e.g. diabetic retinopathy, hypertensive retinopathy, optic neuritis, papilledema, Grave’s ophthalmopathy, etc., as well as common eye diseases, e.g. cataracts and glaucoma. This series of lectures is presented as case problems on which students work prior to the lecture. This “problem-solving” approach has proved to be more successful and more informative than the strict didactic lecture approach. Dr. M. Smith and Staff

THIRD YEAR

In the third year, students spend one week in the outpatient eye clinic examining patients with ophthalmology residents. During this week, the students have discussion sessions on various topics with members of the faculty, e.g., differential diagnosis of the “red eye,” how to interpret an ophthalmologic consult note, how to handle an ocular emergency in the emergency room (chemical burns, etc.). During this one week, there is again emphasis on the use of the ophthalmoscope, and a problem solving case history-photo album is worked on by the students. Dr. M. Smith and Staff

FOURTH YEAR ELECTIVE

The fourth year is a clinical clerkship geared to the student who plans to enter the specialty of ophthalmology. The student’s role is that of an extern in that he/she performs the history and ocular exam on patients in the outpatient clinic and/or the various services within the department, e.g. University Eye Service, glaucoma unit, neuroophthalmology unit, etc. The student is expected to present cases at rounds and conferences. There are one or two students on each of these services for six or twelve weeks. Dr. M. Smith and Staff
RESEARCH ELECTIVES

Ocular immunology. Dr. Ferguson

Dr. Er-Kai Gao

Compliance to medical therapy. Dr. Gordon

Dr. Hart

Molecular genetics of the lens. Dr. Hay

Immunologic studies of uveitis and retinitis.

Dr. Kaplan

Dr. Leib

Computer application to visual fields.

[Faculty]

Professor Emeritus

Robert A. Moses, M.D., University of Maryland, 1942.

Dr. Pepose

Molecular virology. Dr. Pepose

Molecular genetics and biology of cataracts. Dr. Petruss

Pharmacology of aqueous humor and trabecular meshwork. Dr. Romano

Strabismus and amblyopia. Dr. Tychsen

Biochemistry and pharmacology in glaucoma. Dr. Wax

Molecular mechanisms in melanomas. Dr. Fleming

[Professor Emeritus (Clinical)]

Edward Okun, M.D., University of Vermont, 1956.

[Professors (Clinical)]

George M. Bohigian, M.D., St. Louis University, 1965.


Jack Hartstein, M.D., University of Cincinnati, 1955.

Jack Kayes, M.D., Washington University, 1957.

Benjamin Milder, M.D., University of California, 1939.

James E. Miller, M.D., Medical College of Alabama, 1949. (See Department of Pediatrics.)

Stephen R. Waltman, M.D., Yale University, 1964.

[Associate Professor]

Jay S. Pepose, Ph.D., University of California, Los Angeles, 1980; M.D., 1982. (See Department of Pathology.)

Martin B. Wax, M.D., University of Southern California, 1978.

[Associate Professors Emeriti (Clinical)]

Howard R. Hildreth, M.D., Washington University, 1928.

Glen P. Johnston, M.D., Washington University, 1956.

Harry D. Rosenbaum, M.D., Washington University, 1934.

Theodore E. Sanders, M.D., University of Nebraska, 1933.

[Neva P. Arribas, M.D., Manila Central University, 1954.


Isaac Boniuk, M.D., Dalhousie University, 1962.

Dean B. Burgess, M.D., University of California, 1967.


M. Gilbert Grand, M.D., Yale University, 1968.

Terence G. Klingle, M.D., University of California, 1970.

Harry L. Knopf, M.D., Harvard Medical School, 1957.


Bernd Silver, M.D., University of Louisville, 1956.

Mitchel L. Wolf, M.D., Albert Einstein College of Medicine, 1968.

[Assistant Professors]

Usha P. Andley, Ph.D., Jawaharlal Nehru University, 1977.

Debra A. Barrett, M.D., Yale University, 1979. (See Department of Neurology and Neurosurgery.)

Christine Blazynski, Ph.D., Purdue University, 1981. (See Departments of Biochemistry and Molecular Biophysics and Anatomy and Neurobiology.)
Lucian V. Del Priore, M.D.,
University of Rochester, 1982;
Ph.D., Cornell University, 1984.
(See Department of Biochemistry
and Molecular Biophysics.)

Thomas A. Ferguson, Ph.D.,
University of Cincinnati, 1982. (See
Department of Pathology.)

Timothy P. Fleming, Ph.D.,
University of Missouri, 1985. (See
Department of Genetics.

David A. Leib, Ph.D., The
University of Liverpool, 1986. (See
Department of Molecular Microbiol-

Anthony J. Lubniewski, M.D.,

Peter D. Lukasiewicz, Ph.D.,
University of Michigan, 1984. (See
Department of Anatomy and Neurobiology.

J. Mark Petrasch, Ph.D., University
of Texas, Galveston, 1981. (See
Department of Genetics.

Lawrence Tychsen, M.D.,
Georgetown University. (See
Department of Anatomy and Neurobiology.)

Research Assistant
Professors

Nalini S. Bora, Ph.D., All India
Institute of Medical Science, 1981.

Er-Kai Gao, M.D., Peking Medical
College, 1983. (See Department of
Pathology.)

Mae Gordon, Ph.D., University of
Wisconsin, 1978. (See Division of
Biostatistics.)

Regine E. Hay, Ph.D., North
Carolina State University, 1974.

Rajkumar V. Patil, Ph.D., National
Chemical Laboratory, India, 1985.

Carmelo Romano, Ph.D., Stanford
University, 1981.

Martin S. Silverman, Ph.D.,
University of California, San
Francisco, 1984. (See Central
Institute for the Deaf.)

Assistant Professors
Emeriti (Clinical)

William H. Meinberg, M.D.,
Washington University, 1932.

Lawrence T. Post, Jr., M.D.,
Washington University, 1948.

Philip Venable, M.D., Wayne
State University, 1940.

Assistant Professors
(Clinical)

Stanley C. Becker, Ph.D.,
Washington University, 1951; M.D.,
Chicago Medical School, 1955.

Edward F. Berg, M.D.,
Washington University, 1964.

Ronald C. Bilchik, M.D.,
Washington University, 1967.

Samuel A. Canaan, Jr., M.D.,
Meharry Medical College, 1954.

Philip L. Custer, M.D., Vanderbilt
University, 1978.

Lawrence A. Gans, M.D., Case
Western Reserve University, 1977.

James M. Gordon, M.D.,
University of Minnesota, 1966.

Kenneth O. Green, M.D.,
University of Missouri, 1960.

Michael J. Isserman, M.D.,
Washington University, 1975.

William S. Joffe, M.D.,
Washington University, 1963.

Stephen A. Kamenetzky, M.D.,
Washington University, 1970.

Cynthia Z. Kenneally, M.D.,
University of Missouri, 1982.

Robert L. Lamberg, M.D.,
Washington University, 1976.

Barry D. Milder, M.D.,

Duane L. Mitzel, M.D., Washing-
ton University, 1977.

Matthew Newman, M.D.,
Columbia University, 1959.

F. Thomas Ott, M.D., Washington
University, 1965.

John C. Perlmutter, M.D., Cornell
University Medical College, 1971.

Louis J. Rosenbaum, M.D.,
Washington University, 1963.

Michael B. Rumelt, M.D.,
Washington University, 1966.

Lawrence H. Schoch, Jr., M.D.,
University of Louisville, 1976.

Philip T. Shahan, M.D.,
Washington University, 1942.

Arthur W. Stickle, Jr., M.D.,
University of Oklahoma, 1943.

Matthew A. Thomas, M.D.,
Harvard Medical School, 1981.

William L. Walter, M.D., Ohio
State University, 1954.

Stephen A. Wexler, M.D.,
University of Michigan, 1982.

Charles E. Windsor, M.D.,
University of Rochester, 1960.

Research Instructors

Keith A. Laycock, Ph.D.,
University of Bristol, 1989.

Judith Kelvin Miller, Ph.D.,
Washington University, 1986.

Instructor Emeritus
(Clinical)

Ruth S. Freedman, M.D.,
Washington University, 1942.

Maxwell Rachlin, M.D., University
of Toronto, 1942.

Instructors (Clinical)

Nevinkumar J. Amin, M.B.B.S.,
Bombay University, 1966.

William L. Becker, M.D., Wash-
ington University, 1987.

Gregg J. Berdy, M.D., St. Louis
University, 1983.

Bruce H. Cohen, M.D., The Johns
Hopkins Medical School, 1980.

Nicholas N. Colosi, M.D., St. Louis
University, 1968.

Bruce S. Frank, M.D., Washington
University, 1976.

Robert W. Jones, M.D., Washington
University, 1984.

Paul F. Nichols, M.D., University
of California, 1982.

Mickey L. Salmon, M.D.,
Louisiana State University, 1995.

Steven M. Shields, M.D.,
Washington University, 1986.

Mark H. Spurrier, M.D.,
Washington University, 1990.

David F. Williams, M.D., Medical
College of Ohio, 1984.
DEPARTMENT OF
OTOLARYNGOLOGY
OTOLARYNGOLOGY

Otolaryngology is presented to students in the Second, Third, and Fourth Year Classes. A clinical pathologic correlation lecture series is presented to sophomores. In the third year of the medical curriculum, each student spends one week on one of the services in East Pavilion or St. Louis Veterans Administration. During this period there is teaching at the bedside, in the operating room, and in the clinic, supplemented by daily afternoon lectures, grand rounds on Wednesdays, and an introduction to audiology as well as to basic ENT research.

Fourth-year students who show a special interest may take a rotating elective in ENT suited to their interests. Some possibilities include research or clinical work. Ample research facilities and ongoing projects are available. Clinical exposure could include oncologic diseases related to the head and neck, otologic diseases, oto-neurology, audiology, or middle ear surgery.

The postgraduate program in Otolaryngology at Washington University School of Medicine consists of one year of general surgery and one year of research in otolaryngology. Following this, there are four years of otolaryngology. During the clinical years of training, residents rotate on various services, which include the Head and Neck Surgery Service at Barnes Hospital, the ENT Clinic, Otolaryngology, Plastic Surgery Service, the Veterans Administration Hospitals, Children's Hospital, Jewish Hospital, and St. Louis Regional Hospital. During that time, the resident serves in all aspects of patient care including the outpatient clinic, inpatient hospital care, and the operating room, as well as the various ENT diagnostic laboratories such as vestibular and audiology.

There is an increasing degree of responsibility given to residents as they proceed during the training program, depending upon the year in training and also the resident's personal professional development during this time. Didactic teaching consists of a basic science course during the first year of clinical residency. There is also a temporal bone otology course, as well as a head and neck dissection course. Throughout the year, there are didactic lectures on a weekly basis. These lectures consist of Grand Rounds, Morbidity and Mortality Conference and a series of instructional lectures throughout the year which cover all aspects of otolaryngology. During the clinical years, residents are expected to participate in clinical and/or basic research and to publish papers in peer-reviewed journals and they are expected to make presentations at the lectures or Grand Rounds. They are encouraged to submit papers and to make presentations at regional and national otolaryngology meetings. There is a national course consisting of literature given by the American Academy of Otolaryngology in which residents are expected to participate throughout the year. There is also an In-Training Examination given by the American Academy of Otolaryngology which all residents must take on a yearly basis. Throughout their residency, residents receive training in all aspects of otolaryngology including general otolaryngology, head and neck cancer surgery, microvascular reconstructive techniques, facial plastic surgery, oto-neurology, and pediatric otolaryngology including pediatric endoscopy, allergy and endoscopic nasal sinus surgery.

SECOND YEAR

Otolaryngology and Physical Diagnosis
Clinical pathologic correlation lectures in otolaryngology are given to the entire class. Subjects include ear disease, vertigo, nose, sinus and larynx problems and head and neck cancer. Dr. Goebel

THIRD YEAR

Otolaryngology Clerkship
Practical instruction in diagnosis and treatment. Students rotate on the ENT service. This consists of ENT Outpatient Clinic, in-hospital patients and the operating room. One week. Dr. Goebel

FOURTH YEAR ELECTIVES

Clinical Clerkship in Otolaryngology
Six week rotation includes evaluation of ENT problems presented to specialist for diagnosis and treatment. The student participates in the clinic, hospital and operating room. Also includes rotation on the Pediatric ENT Service, Audiology Voice Laboratory and Vestibular Evaluation Laboratory. Two students are accepted for each rotation. Students select their own options depending on their needs. Dr. Thawley

Practicum in Clinical Audiology
Guidance provided in the administration and interpretation of audiometric tests. Emphasis on defining the severity of auditory dysfunction in addition to identifying sites of pathological processes. Theoretical bases of acoustics, anatomy and physiology, and electronics reviewed as they relate to auditory assessment. Modification of conventional test paradigms and hearing aid procedures covered according to each student's interests and needs. Dr. Skinner

Neurotology
Active student participation in the physical exam. Advanced testing and management of patients with balance dysfunction. Attend patient clinic 2 days a week and test patients on ENG, rotary chair and computerized platform 3 days a week. Research participation welcome with prior arrangements. Dr. Goebel
**RESEARCH ELECTIVES**

**Inner ear microanatomy and pathology (light- and electron-microscopy).** The effects of various ototoxic agents (e.g., noise, radiation, etc.) on the structure of the inner ear are determined using light and electron microscopic evaluation of the cochlear tissues. *Dr. Bohne*

**Topics in microvascular surgery.** Drs. Fredrickson, Hayden, Highstein

Glass microelectrodes, intra- and extra-cellular labels, computers, light and electron-microscopy are used to study aspects of the central and peripheral vestibular system with an emphasis on vestibular efferents in anesthetized and alert fish and squirrel monkeys. *Dr. Highstein*

**Evaluation and treatment methods for disorders of the velopharynx and larynx in children.** Dr. Muntz

Clinical laboratory diagnosis and research into normal and non-normal speech with special emphasis on voice disorders. Students will become familiar with diagnostic procedures and instrumental techniques. *Dr. Painter*

Computer based studies of head and neck cancer treatment and results. *Dr. Sessions*

Research in implantable hearing aids. Drs. Slatin, Fredrickson

Biochemistry and pharmacology of the inner ear. *Dr. Thalmann*

Advanced testing of the vestibulo-ocular reflex (VOR), rotary chair and headshake testing. Posture control testing utilizing computerized dynamic platform posturography. *Dr. Goebel*

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**Faculty**

**Lindburg Professor and Head of Department**


**Professors Emeriti**

S. Richard Silverman (Audiology), Ph.D., Washington University, 1942. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)


**Professors**

Barbara A. Bohne, Ph.D., Washington University, 1971.

George A. Gates, M.D., University of Michigan, 1939.

Stephen M. Highstein, M.D., University of Maryland Medical School, 1965; Ph.D., University of Tokyo Faculty of Medicine, 1976. (See Department of Anatomy and Neurobiology.)


Donald G. Sessions, M.D., Washington University, 1962.


Ruediger Thalmann, M.D., University of Vienna, 1954.

**Research Professors Emeriti and Lecturers**


Donald H. Eldredge, M.D., Harvard University, 1946. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)

**Research Professors**

Ira J. Hirsh (Audiology), Ph.D., Harvard University, 1948. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)

James D. Miller, Ph.D., Indiana University, 1957.

Richard G. Stoker, Ph.D., McGill University, 1980.

**Professors Emeriti (Clinical)**

Benard C. Adler, M.D., Washington University, 1937.

Harold M. Cutler, M.D., Tufts College, 1937.

Morris Davidson, M.D., Indiana University, 1938.


**Associate Professor**

Joseph E. Harvey (Experimental Otolaryngology), Ph.D., University of California, Berkeley, 1968.

Rodney P. Lusk, M.D., University of Missouri, 1977. (See Department of Pediatrics.)

Harlan R. Muntz, M.D., Washington University School of Medicine, 1977. (See Department of Pediatrics.)

Stanley E. Thawley, M.D., University of Texas Medical Branch, 1967.

**Research Associate Professor**


**Associate Professors Emeriti (Clinical)**

Guertdan Hardy, M.D., Washington University, 1929.

Robert E. Votaw, M.D., State University of Iowa, 1929.
Otolaryngology

Associate Professors (Clinical)

Carl F. Ehrlich, M.D., University of Missouri, 1965.
Laurence A. Levine, M.D., Albany Medical College of Union University, 1971.
Edward H. Lyman, M.D., Washington University, 1937.
Wayne A. Viers, M.D., University of Oklahoma, 1956.
Joseph W. West, M.D., Duke University, 1944.

Assistant Professors

Dennis P. Fuller (Speech Pathology), Ph.D., St. Louis University, 1982.
Joel A. Goebel, M.D., Washington University, 1980.
Dec Jay Hubbard (Speech Pathology), Ph.D., University of Iowa, 1967.
Claire Matthews (Speech Pathology), Ph.D., University of Kansas, 1980.
Jeffrey H. Owen (Audiology), Ph.D., University of Arizona, 1979.
Margaret G. Peak (Audiology), Ph.D., Columbia University, 1975.
Alec N. Salt, Ph.D., University of Birmingham, 1977.
Margaret W. Skinner, Ph.D., Washington University, 1976.

Research Assistant Professor

Isolde Thalmann, Ph.D., California Western University, 1982.

Assistant Professors Emeriti (Clinical)

Donald R. Ingram, M.D., University of Illinois, 1956.
Herbert M. Smit, M.D., St. Louis University, 1955.

Assistant Professors (Clinical)

Wallace P. Berkowitz, M.D., Boston University, 1967.

Norman S. Druck, M.D., University of Illinois, 1970.
Jeffrey Fierstein, M.D., Albert Einstein College of Medicine, 1971.
Jacques A. Herzog, M.D., University of Missouri, Kansas City, 1980.
George J. Hruza, M.D., New York University School of Medicine, 1982.
Timothy N. Kaiser, M.D., Harvard University, 1982.
Roanne G. Karzon (Audiology), Ph.D., Washington University, 1982.
Phillip L. Martin, M.D., St. Louis University, 1968.
Supote Phipatanakul, M.D., Chulalongkorn Hospital Medical School, 1965.
Albert F. Ruehl, M.D., St. Louis University, 1973.
Peter G. Smith, Ph.D., Purdue University, 1972; M.D., Medical University of South Carolina, 1976.
J. Regan Thomas, M.D., University of Missouri, 1972.
Lloyd Thompson, M.D., Howard University, 1964.
Michael Valente (Audiology), Ph.D., University of Illinois, 1975.

Instructor Emeritus

Marion P. Bryan, A.B., Washington University, 1951.

Instructors

Andrew N. Goldberg, M.D., Boston University, 1985.
Randal C. Paniello, M.D., University of Illinois College of Medicine, 1984.
Mark F. Stroble, M.D., University of Missouri, 1985.

Instructors (Clinical)

Louis S. Altschuler, D.D.S., Ohio State University, 1945.

Gerald Bart, M.B.B.S., Kanpur University, 1963.
Phadung Chadaratana, M.D., Mahidol University Medical School, Bangkok, Thailand, 1964.
Sheldon C. Cohen, D.M.D., Southern Illinois University at Alton School of Dental Medicine, 1976.
J. Michael Conoyer, M.D., Vanderbilt University, 1975.
Tamara E. Ehert, M.D., University of Wisconsin, 1983.
James A. Fernandez, M.D., St. Louis University, 1981.
John W. McKinney, M.D., University of Missouri, 1979.
Stephen B. Overton, M.D., University of Michigan, 1967.
Robert Ryan, Jr., M.D., St. Louis University, 1973.
D. Gordon Schall, M.D., University of Missouri, Kansas City, 1977.
Alan P. K. Wild, M.D., Tulane University, 1983.

Research Instructors


Research Associates

William Clark, Ph.D., University of Michigan, 1975; (Also Central Institute for the Deaf)
Timothy A. Holden, B.S.E., University of Iowa, 1984.
**PATHOLOGY**

Modern pathology is concerned with the molecular and ultrastructural basis of disease. Historically, morphologic studies provided the foundations of our concepts of disease, and ultrastructural studies continue to add to our understanding, but modern pathology utilizes virtually all of the tools of basic sciences. Pathologists are involved in diagnostic, teaching, and research activities.

In addition to the second year of pathology, the department conducts numerous combined conferences which third- and fourth-year students attend as part of individual clinical clerkships. These are described below.

Students, usually in their fourth year, may elect to participate in advanced courses or clerkships in autopsy or surgical pathology or laboratory medicine, or to pursue research in experimental pathology. The department offers a course of study leading to the Ph.D. degree. Medical students who desire to combine graduate and medical programs of study should consult Dr. Jacques Baenziger.

For the purpose of teaching, research, and service, the department is divided into specialty divisions under the following directors:

- Division of Anatomic Pathology, Dr. L. Dehner
- Division of Laboratory Medicine, Dr. J. Miletich
- Division of Neuropathology, Dr. W. Hickey
- Division of Experimental Pathology and Immunology, Dr. E. Unanue, Dr. R. Schreiber
- Autopsy Pathology, Dr. J. Saffitz
- Jewish Hospital/Department of Pathology, Dr. S. Teitelbaum
- Graduate Program in Immunology, Dr. R. Schreiber
- Pathology Course/Coursemaster, Dr. S. El-Mofty

**SECOND YEAR**

*Bio 515, 516. General Pathology*

This course is a comprehensive survey of the biology and morphology of human disease. The year begins with a review of basic mechanisms of disease at the cellular and molecular level. Subsequently, the characteristics of major pathologic entities affecting the organ systems of the human body are presented, employing both lectures and laboratory sessions. In the laboratories, small groups of students directly examine gross and microscopic specimens with the assistance of members of the faculty and housestaff. These exercises reinforce the material presented in lecture and give students an opportunity to acquire the basic skills required for making pathologic diagnoses. **Staff**

**THIRD AND FOURTH YEARS**

**Clinical Pathological Conference**

The clinical history and treatment of patients who have died are discussed before the class by the physicians and surgeons of the departments concerned. These conferences afford students an opportunity to interpret the clinical observations in light of the postmortem findings. One hour a week during the year. **Staff**

**Laboratory Medicine Conference**

One hour each week for twelve weeks during Internal Medicine rotations. Problem cases and general principles of Laboratory Medicine are discussed. **Staff**

**Tumor Conference**

One hour each week for twelve weeks during the surgery and obstetrics and gynecology clerkships. Problem cases are presented for illustration and discussion of all aspects of neoplastic disease. **Staff**

**RESEARCH**

*Bio 590. Research Opportunities*

The department encompasses all the major areas of investigation in experimental pathology, immunobiology, and cell biology. Examples include:

- Biochemistry of protein handling in immune induction. Dr. Allen
- Examination of glycoprotein oligosaccharides and their role in endocytosis and cellular recognition. Dr. Baenziger
- Collagen metabolism and pulmonary pathology. Dr. Crouch
- Academic surgical pathology. Dr. L. Dehner
- Major focus on neoplasia of the head and neck; particularly salivary gland tumors and carcinoma of the upper aerodigestive tract. Dr. S. El-Mofty
- Human genome mapping and molecular genetics. Dr. E. Green
- Mechanisms of class I and II MHC antigen processing for microbial and soluble antigens; T lymphocyte antigen recognition and autoimmunity. Dr. C. Harding
- Renal pathology, pediatric pathology. Dr. Kissane
- The regulation of T cell activation. Dr. O. Kanagam
- Vitamin D. effects on Lymphocyte activation. Dr. D. Lacey
- Experimental diabetes mellitus, tissue culture of islets, transplantation of islets. Dr. Lacy
- Development of monoclonal antibodies for assessing isoenzymes. Dr. Ladenson
- Cell surface complement receptors—structure and function. Dr. Lublin
Experimental diabetes: biochemical studies of insulin release mechanisms in vitro. Dr. McDaniel

Pathology of Alzheimer's Disease. Dr. McKeel

Developmental expression of genes regulated by nerve growth factor. Dr. Milbrandt

Molecular biology of blood coagulation. Dr. Miletich

Use of transgenic mice to examine lymphocyte activation. Dr. K. Murphy

Studies on antibiotic susceptibility of aerobic and anaerobic bacteria. Dr. Murray

Studies of human IgG subclass expression. Dr. Nahm

Statistical theory and computer technology applications in laboratory medicine. Dr. Parvin

Characterization of the neuroendocrine cellular system. Dr. K. Roth

Experimental cardiovascular pathology; structure-function relationships in ischemic heart disease. Dr. Saffitz

Biochemical mechanisms of cell-substrate and cell-cell adhesion as manifest by blood platelets. Dr. Santoro

Pathogenesis of experimental diabetic autonomic neuropathy. Dr. Schmidt

Biochemistry and biology of lymphokines. Dr. Schreiber

Immunopathology of renal disease. Dr. Schreiner

The role of tyrosine kinases in T cell activation. Dr. A. Shaw

Placental transport and surface membrane structure and function. Dr. C. Smith

Phenotypic characterization of reactive and neoplastic human cells, primarily using immunohistochemical techniques, with special emphasis on pediatric and soft tissue neoplasms. Dr. P. Swanson

Metabolic bone disease. Dr. Teitelbaum

The control of lymphocyte activation by protein tyrosine dephosphorylation. Dr. Thomas

Immunopathology of autoimmune diseases. Dr. Tung

Arachidonic acid biochemistry and the regulation of insulin secretion. Dr. Turk

Immunobiology and immunopathology of lymphocyte-macrophage interactions. Dr. Ulatove

Cellular interactions in immunity. Dr. C. Weaver

Immunocytochemistry and electron microscopy. Dr. M. Wick
Vascular structure and function; pathophysiology of diabetic and ischemic vascular disease. Dr. Williamson

Alterations in gene expression in hematopoetic differentiation and malignancy. Dr. M. Zutter

**ELECTIVES**

**Advanced Special Pathology**
A series of seminars discussing timely selected topics in special pathology of human disease, augmented by illustrative cases and emphasizing clinicopathologic correlations. Reading lists will be circulated and active discussion is encouraged. If the size of the group makes it practical to do so, each student will prepare and conduct a session on a subject of their choice. Drs. Dehner, Wick & Kissane

**Autopsy Pathology**
A full-time elective held during periods 4-8. Students assist in performing autopsies and participate fully in the activities of the Autopsy Service. Supervision is by faculty and housestaff pathologists. Emphasis is placed on the student learning as much gross pathology as possible as a preparation to be a pathologist or to serve as a general background in medical, surgical, and neurologic diseases. Weekly conferences include gross and microscopic neuropathology, specialty pathology conference, two research seminars, CPC and autopsy case review conference. Students will help prepare preliminary and final autopsy reports and will do a clinicopathologic project and present their results to the housestaff and attending faculty. Dr. Saffitz and Staff

**Cell Biology of the Immune System**
This is a seminar course on the biology of lymphocytes and macrophages and their interaction in normal and pathological conditions. Some background in Immunology is desirable. The course places emphasis on current research on how macrophages function in regulating the immune system in normal conditions, in infectious diseases, and in autoimmunity. Students will read and discuss two to three papers per session. Drs. Unanue, Allen, Schreiber & Thomas

**Neuropathology**
Clinical pathological correlations of neurological diseases will be investigated by the case study method using current and documented material. Participants will partake in gross neuropathological examinations and will be assigned selected cases for discussion of clinical data and gross and microscopic pathological findings, especially in relationship to evolution and mechanism of disease processes. Topics covered will include vascular, infectious, demyelinating, and neuronal diseases, as well as neoplasms of the nervous system. Dr. Hickey

Clinical Laboratory Medicine
See Department of Medicine. Dr. Santoro and Staff

Anatomic Pathology—Jewish Hospital
This elective is designed to reacquaint students who have had some clinical experience with the morphological basis of disease, and to permit them to review normal morphological relationships. During the elective students will learn to perform gross autopsy dissections, and will be taught how to select appropriate tissue samples for further microscopic, histochemical, immunofluorescent, and electron microscopy study. Subsequently, they will learn how to perform these procedures under supervision of members of the Anatomic Pathology Staff and how to interpret their results. Following completion of appropriate studies, an in-depth report of clinical pathological correlations will be prepared for each autopsy performed. This elective is considered appropriate for students who intend careers in Internal Medicine, Surgery and Radiology. Dr. Teitelbaum and Staff

Laboratory Medicine—Jewish Hospital
Intensive elective training in Laboratory Hematology includes training in immunohematology, coagulation and special as well as routine laboratory hematology procedures. Emphasis will be placed on laboratory procedures and their relationship with patient diagnosis and management. Dr. Teitelbaum

Surgical Pathology—Jewish Hospital
This elective is designed to acquaint students with the discipline of Surgical Pathology and to permit them to develop basic skills in histopathological interpretation. This elective will be offered to only one student/period in order to permit maximum
interaction with the Surgical Pathology Staff and House Officers. During the course of the elective, the student will be taught to function as a junior House Officer. The student will participate in the examination and dissection of gross specimens, take operating room calls, learn frozen section diagnosis, and formulate histopathological diagnoses, all in conjunction with members of the Senior Staff. Since the Laboratory of Surgical Pathology at Jewish Hospital processes a broad range of medical biopsy material as well as specimens derived from busy surgical subspecialty practice, the elective is considered desirable for students who plan careers in internal medicine and surgery as well as for those who intend to enter the field of pathology.

Dr. Crouch

Surgical Pathology

Surgical pathology offers an elective for a 6-week period under Surgical Pathology I. Students participate fully in activities of the Division of Surgical Pathology and they are responsible for dissection and description of gross specimens and microscopic diagnosis under supervision of the senior staff of the Division. Students attend morning conferences with the Director, surgical and medical grand rounds, tumor and subspecialty conferences. In addition, Surgical Pathology II includes rotations through selected subspecialties: Neuropathology, Hematopathology, Dermatopathology, ENT Pathology, and Gynecologic Pathology. Drs. Dehner, Wick and Staff

Obstetrical and Gynecological Surgical Pathology

This 6-week elective offers an intensive experience in Ob-Gyn Pathology involving current surgical material from the Ob-Gyn service. Students will be expected to participate fully in the daily activities in the examination of specimens under the supervision of the senior staff. Slide reviews and conference material will be discussed. Students will attend departmental conferences and the Gyn Tumor Conference. Dr. Gersell and Staff

In addition to the above, the department offers several advanced courses in the Division of Biology and Biomedical Sciences. These courses are listed below, but are described in the offerings of the Division of Biology and Biomedical Sciences.

Bio 504. Environmental Pathology
Bio 518, 519. Pathology Research Seminar
Bio 5271, 5272. Topics in Immunology

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.
Faculty

Edward Mallinckrodt Professor and Head of Department

Emil R. Unanue, M.D., University of Havana, 1960.

Professors Emeriti

Lauren V. Ackerman (Pathology and Surgical Pathology), M.D., University of Rochester, 1932. (Also Consultant)

Hugh Chaplin, Jr., M.D., Columbia University, 1947. (See Department of Medicine)

Ruth Silberberg, M.D., University of Breslau, 1931. (Also Lecturer)

Professors

Jacques U. Baenziger, M.D., Washington University, 1975; Ph.D., 1975. (See Department of Cell Biology and Physiology)


Gerald Kessler, Ph.D., University of Maryland, 1954. (Jewish Hospital)

John M. Kissane, M.D., Washington University, 1952. (See Department of Pediatrics)

Michael Kyriakos, M.D., Albert Einstein College of Medicine, 1962.

Robert L. Kroc Professor

Paul E. Lacy, M.D., Ohio State University, 1948; Ph.D., University of Minnesota, 1955.

Jack H. Ladenson, Ph.D., University of Maryland, 1971. (See Department of Medicine)

Michael L. McDaniel, Ph.D., St. Louis University, 1970.

Joseph P. Miletich, M.D., Ph.D., Washington University, 1979. (See Department of Medicine)

Thalachallour Mohanakumar, Ph.D., Duke University, 1974. (See Departments of Medicine and Surgery)

Patrick R. Murray, Ph.D., University of California, 1974. (See Department of Medicine)

John W. Olney, M.D., University of Iowa, 1963. (See Department of Psychiatry)

Alan Pestrunk, M.D., The Johns Hopkins University, 1970. (See Department of Neurology and Neurological Surgery)

Samuel A. Santoro, M.D., Ph.D., Vanderbilt University, 1979. (See Department of Medicine)

Robert D. Schreiber, Ph.D., State University of New York, 1973. (See Department of Molecular Microbiology)

Carl H. Smith, M.D., Yale University, 1959. (See Department of Pediatrics)

Morton E. Smith, M.D., University of Maryland, 1960. (See Department of Ophthalmology and Visual Sciences)

Wilma and Roswell Messing Professor

Steven L. Teitelbaum, M.D., Washington University, 1964. (Jewish Hospital)


Joseph R. Williamson, M.D., Washington University, 1958.

Professor (Clinical)

Richard Torack, M.D., Georgetown University, 1952.

Professor (Visiting Staff)

Frederick T. Kraus, M.D., Washington University, 1955.

Adjunct Professor

Brian L. Clevinger, Ph.D., Indiana University, 1977.

Associate Professors

Paul M. Allen, Ph.D., University of Michigan, 1981.

Edmond C. Crouch, Ph.D., University of Washington, 1978; M.D., 1979. (Jewish Hospital)


Deborah J. Gersell, M.D., Washington University, 1975.

Peter A. Humphrey, M.D., Ph.D., University of Kansas, 1984.

Louis G. Lange III, M.D., Ph.D., Harvard University, 1976. (See Department of Medicine)

Daniel W. McKeel, M.D., University of Virginia, 1966.

Jeffrey D. Milbrandt, M.D., Washington University, 1979. (See Department of Medicine)


George F. Schreiner, M.D., Harvard Medical School, 1975; Ph.D., Harvard University, 1977. (See Department of Medicine)

Matthew L. Thomas, Ph.D., University of Utah, 1981. (See Department of Medicine)

John W. Turk, M.D., Washington University, 1976; Ph.D., 1976. (See Department of Medicine)

Research Associate Professor

Osami Kanagawa, M.D., Okayama University, 1974; Ph.D., 1978. (See Department of Medicine)

Michael L. Landt, Ph.D., University of Oregon, 1976. (See Department of Pediatrics)

Associate Professor (Visiting Staff)

Daniel J. Santa Cruz, M.D., University of Buenos Aires, 1971.

Soman N. Abraham, Ph.D., University of New Castle upon Tyne, England, 1981. (Jewish Hospital)
Morey A. Blinder, M.D., St. Louis University, 1981. (See Department of Medicine.)

Cheryl M. Coffin, M.D., University of Vermont, 1980.

Thomas A. Ferguson, Ph.D., University of Cincinnati, 1982. (See Department of Ophthalmology and Visual Sciences.)


Jonathan D. Gitlin, M.D., University of Cincinnati, 1982. (See Department of Ophthalmology and Visual Sciences.)


Jonathan D. Gitlin, M.D., University of Cincinnati, 1982. (See Department of Ophthalmology and Visual Sciences.)

Eric D. Green, M.D., Ph.D., Washington University, 1987. (See Department of Medicine.)

Leonard E. Gross, M.D., University of Wisconsin, 1980; Ph.D., 1985. (Jewish Hospital)

Clifford V. Harding, M.D., University of Chicago, 1978. (See Department of Medicine.)

V. Michael Holers, M.D., Washington University, 1978. (See Department of Medicine.)

Glen L. Horiott, Ph.D., Washington University, 1983; M.D., 1983. (See Department of Pediatrics.)


David L. Lacey, M.D., University of Colorado, 1983; M.D., 1983. (Jewish Hospital)

Douglas N. Lublin, Ph.D., Stanford University, 1970; M.D., University of California, Los Angeles School of Medicine, 1982. (See Department of Medicine.)

John C. Morris, M.D., University of Rochester, 1974. (See Department of Neurology and Neurological Surgery.)

Kenneth M. Murphy, Ph.D., The Johns Hopkins University School of Medicine, 1982; M.D., 1984.

Jay S. Pepose, Ph.D., University of California, Los Angeles, 1980; M.D., 1982. (See Department of Ophthalmology and Visual Sciences.)

Kevin A. Roth, M.D., Ph.D., Stanford University, 1985.

Andrey S. Shaw, M.D., Columbia University, 1984.

Paul E. Swanson, M.D., Oregon Health Sciences University School of Medicine, 1984.

Herbert W. Virgin IV, M.D., Ph.D., Harvard University, 1985. (See Department of Medicine and Department of Microbiology.)

Casey T. Weaver, M.D., University of Florida, 1984.

Mary M. Zutter, M.D., Tulane University School of Medicine, 1981.


Derry Woodford-Thomas, Ph.D., Virginia Polytech, 1982.

Research Assistant Professors (Clinical)

Curtis A. Parvin, Ph.D., University of Minnesota, 1980. (See Department of Medicine and Division of Biostatistics.)

Mitchell G. Scott, Ph.D., Washington University, 1982. (See Department of Medicine.)

Viktor A. Silva, M.D., St. Louis University, 1971. (See Department of Medicine.)

Research Assistant Professors (Clinical) (Visiting Staff)


Gregory S. King, M.D., Washington University, 1979. (See Department of Medicine.)
Instructors
Rosa Maria Davila, M.D., University of Puerto Rico School of Medicine, 1981. (Jewish Hospital)
Charles S. Eby, M.D., Vanderbilt University, 1981. (See Department of Medicine.)
James F. Fitzgibbon, MBBCh, University of College Cork, 1982.
Helen Liapis, M.D., University of Athens, 1972. (Jewish Hospital)
Mary Anne Rudloff, M.D., Washington University, 1979. (Jewish Hospital)
Linda J. Shires, MBBCh, Witwatersrand University, 1974. (Jewish Hospital)
William D. Staatz, Ph.D., University of Edinburgh, 1976.
Thuy-Lieu Vo, M.D., Washington University, 1985. (Jewish Hospital)

Research Instructors
Katherine C. Chang, Ph.D., University of Iowa, 1974.
Dorothy J. Fiete, B.S., Marymount College, 1966.
Reginald James Matthews, Ph.D., University of Wales College of Medicine, 1988.
Theresa L. Murphy, Ph.D., The Johns Hopkins University, 1983.
Kathleen C. Sheehan, Ph.D., St. Louis University, 1986.

Research Assistants
Shirley B. Carroll, Gradwohl School of Laboratory Technique, 1955.
Katherine E. Frederick, B.S., Bradley University, 1977.
Yvonne Landt, B.S., Oregon State University, 1971; M.S., University of Illinois, 1972.
Santiago Plurad, Ph.D., University of Missouri, 1967.
The primary aim of the teaching program of the Department of Pediatrics is to stimulate interest in developmental biology, especially human growth and development, and to provide the student with a foundation sufficiently comprehensive so that he or she will have an appreciation of pediatric problems regardless of his or her future career choice in medicine.

The major clinical and research facilities are in St. Louis Children's Hospital and the newborn services at Barnes Hospital and Jewish Hospital. St. Louis Children's Hospital is a new facility with 235 beds and accepts patients through 21 years of age with all types of medical problems. Hospital admittances average 10,000 annually. The Pediatric Ambulatory Division averages about 70,000 visits a year. Nearly 5,000 infants are born annually in the Medical Center.

SECOND YEAR
Students are introduced to pediatrics and to the faculty through a series of lectures and symposia designed to acquaint them with the concepts of human growth and development and the effects of age and maturity on reactions to injury and disease. The unique aspects of the physical examination of the infant and child are presented in the Introduction to Clinical Medicine Course. Members of the faculty are active participants in the Sophomore Pathophysiology Course.

THIRD YEAR
A clerkship of six weeks is scheduled where the student participates in the following:
1. Care of inpatients and outpatients, sharing responsibility with resident physicians.
2. Daily rounds and bedside conferences with house staff and attending physicians.
3. Patient management conferences on basic pediatric problems emphasizing pathophysiologic mechanisms.
5. Weekly case conference.
7. Pediatric research conferences.

FOURTH YEAR
This year is devoted to elective time which may be spent according to the individual preferences of the student, who may serve as an intern substitute, in the research laboratory or combine clinical and laboratory work. The following electives are offered:

**Cardiology**
(A) Clinical Elective—Inpatient. The student works as a subintern and is assigned selected patients on the Pediatric Cardiology ward. *Dr. Strauss and Staff*

(B) Clinical Elective—Outpatient. The student will see patients attending all of the outpatient units including both new referrals and follow-up visits. The student will also be responsible for the interpretation of electrocardiograms, echocardiograms, and 24-hour Holter monitor examinations performed in the cardiology non-invasive laboratory. *Dr. Strauss and Staff*

(C) Research.
1. Use of non-invasive imaging techniques (ultrasound, nuclear magnetic resonance) for evaluation and management of congenital heart diseases. *Dr. Canter*
2. Screening studies of family members of patients with congenital heart malformations to ascertain genetic influences on the incidence of congenital heart disease. Non-invasive imaging is used for detection. Studies concerning the regulation of expression of smooth muscle contractile protein genes and involves cell culture, recombinant DNA cloning, sequencing, and immunohematology and in situ hybridization. *Dr. J. Grant*
3. Studies concern the biosynthesis of mitochondrial proteins, regulation of the nuclear genes encoding them, and delineation of the molecular basis of human deficiencies in these genes. This research involves recombinant DNA technology, cloning of various DNA fragments and cell biological techniques. *Dr. Strauss*

**Clinical Laboratories**
(A) Studies concern the mechanism by which glucose increases insulin secretion by pancreatic Beta cells. Of particular interest are the roles of calcium-dependent protein kinases in this mechanism. *Dr. Landt*

(B) Studies examine post-translational processing of plasma proteins and molecular interactions between components of the complement and coagulation pathways. Basic questions of molecular recognition and of structure-activity relationships are addressed using methods of protein and peptide chemistry. *Dr. Hortin*
Pediatrics

Studies investigate the cellular processes underlying the transport of nutrients by the human placental syncytiotrophoblast. Plasma membranes isolated specifically from the maternal- and fetal-facing surfaces and cultured trophoblast cells are used to investigate the transport and metabolism of amino acids and calcium. Dr. Smith

Studies dealing with the rapid diagnosis of viral infections. Techniques include immunofluorescence, DNA probes, polymerase chain reaction amplification of DNA/RNA and flow cytometry for detection of viral antigens/nucleic acids. Specific areas of investigation include the evaluation of quantitative virologic parameters in the diagnosis of cytomegalovirus infection in solid organ transplant recipients and the application of PCR to the diagnosis of congenital infections. Drs. Storch and Arens

Clinical Endocrinology and Metabolism. This elective is designed to include broad clinical experience in pediatric endocrine and metabolic problems. The student has the opportunity to evaluate many pediatric endocrine patients and to see some adult patients during weekly rounds. Emphasis is placed on the practical management of common problems. The student attends rounds and clinics (endocrine, metabolic, and diabetic) and the joint metabolism seminars and rounds held with the medical service. A large number of patients with varied problems are studied in depth during the elective. Drs. Bier, Santiago and Staff

Research.
1. Ongoing research in growth disorders includes the study of children with idiopathic and organic hypopituitarism, gonadal dysgenesis, delayed puberty, and short stature of unknown causes. Laboratory research is aimed at identifying variant forms of growth hormone and the somatomedins which may have decreased biological activity and in employing stable isotope tracer techniques to quantify amino acid and protein kinetics in children with growth failure. Dr. Bier

2. Ongoing studies involve implementation of intensive insulin therapy, including insulin pumps, to determine its role in halting or slowing the progression of diabetes complications and the progressive loss of islet cell function in newly-diagnosed diabetic children. Cross-sectional studies of the natural history of diabetes complications, and especially the relationship to puberty are also underway through the Diabetes Registry of the DRTC. Drs. White and Santiago

3. This laboratory is engaged in the development and application of biochemical techniques to study the structure and function of oligosaccharide units on glycoproteins. The laboratory is currently investigating the biosynthesis and glycosylation of insulin and insulin-like growth factor I (IGF 1) receptors. Dr. Tollefsen

Gastroenterology

A) Natural history studies of pediatric gastrointestinal illness including Henoch Schonlein purpura, x-linked glycoprotein storage disease, vitamin E deficiency and nutritional problems in chronic illness. Drs. Keating, Rothbaum

B) Cellular biochemistry of a genetic defect in transport of alpha-1-antitrypsin through the endoplasmic reticulum; biochemical mechanism for liver and lung injury in alpha-1-antitrypsin deficient individuals; cell specific regulation of alpha-1-antitrypsin gene expression in hepatocytes, enterocytes and macrophages. Dr. Perlmutter

C) The mechanisms involved in the ontogenic expression of canalicular bile acid transport during development. The cellular biology of signaling of the bile acid transport protein to its appropriate domain and subsequent comparison to signaling of other cell surface specific proteins. Dr. Sippel
(D) Transcriptional regulation of the lipolytic proteins, lipase and colipase, is a primary interest. Elements modulating cell-specific expression and secretagogue-regulated expression of these genes are identified by transfecting portions of the gene into cultured cells and then measuring expression of a reporter gene. Additionally, the relationship of lipase and colipase protein structure to their unique function is being investigated by site-specific mutagenesis of the respective cDNAs. Dr. Lowe

**General Pediatrics**

**(A)** General Clinical Pediatrics—St. Louis Children's Hospital. The student will be assigned patients on the general pediatric divisions for initial evaluation and continuing care. The student works as an extern and is expected to take night call every third night. Students work directly under the supervision of the senior resident, and teaching rounds are conducted by the faculty. The elective will provide experience in management of many pediatric medical conditions including a wide variety of acute and chronic disorders. Aspects of growth and development, preventive medicine and the use of Medical Center facilities are located in St. Louis County.)

**Genetics**

**(A)** Clinical Genetics. Students will be exposed to a broad variety of clinical problems encountered in the Division of Medical Genetics. Patients will be seen during inpatient consultation as well as during Genetics Clinic. Emphasis during this rotation will be placed in several areas: (1) learning physical examination skills appropriate for dysmorphic patients; (2) approaches to patients with hereditary metabolic disorders and families with genetic disease; (3) integration of diagnostic laboratory and radiographic studies with clinical information in genetic diseases. Dr. Dowton and Staff

**(B)** Research.

1. Research focuses on: (a) Analysis at the molecular level of the mutations leading to the various forms of x-linked muscular dystrophies with particular emphasis on the Duchenne and Becker types. The initial detection of the mutations and the family analyses are provided by the Molecular Diagnostic Laboratory. (b) Gene mapping of the short arm of the human x-chromosome and particularly of the region surrounding the Ocular Albinism locus. Dr. de Martinville

2. Studies include: (a) The molecular regulation of acute phase proteins using the Syrian hamster as a model for amylodysis. At present we are studying the structure of the genes; peptide and steroid mediators modulating the synthesis of these proteins; the sites of extrahepatic synthesis; and the fetal response to inflammation. (b) Molecular events in familial malignancy. In this project we are examining DNA isolated from specimens of humans for loss of heterozygosity at a variety of loci using cloned probes. Dr. Dowton

3. Primary research has involved the study of fragile sites on human chromosomes and, in particular, the fragile X syndrome. These studies have included segregation analyses and the application of linked DNA markers to improve diagnostic accuracy. In-depth studies are done of rare abnormalities which are detected in the Diagnostic Cytogenetic Laboratory. Dr. Watson

**Hematology and Oncology**

**(A)** Clinical Hematology and Oncology. During this elective students will see a variety of children with hematologic disorders and malignancies. The student will follow patients in the hematology-oncology outpatient unit, work up inpatient consultations, and attend daily hospital rounds on the hematology-oncology patients. The course also includes formal instruction on interpretation of peripheral blood and bone marrow morphology and teaching rounds and conferences. Dr. Schwartz and Staff

**(B)** Research.

1. Basic mechanisms of tumor cell growth and differentiation including the role of growth factors and their receptors.

2. Some tumors are associated with specific chromosomal rearrangements. The identification of these translocations is essential in defining the biological behavior of these tumors and in selecting appropriate therapies. Dr. Dowton

3. Techniques currently used to analyze the genetic regulation of the growth and development of tumor cells. Dr. Dowton and Staff
Infectious Diseases

(A) Clinical Infectious Diseases. This elective is designed to introduce students to the clinical aspects of infectious diseases in children. Students will consult on both inpatients and outpatients. Regular daily activities will include evaluation of new patients, ward rounds on inpatient consultations, microbiology teaching rounds in the bacteriology lab, and teaching rounds with the infectious disease attending. Formal teaching sessions include weekly pediatric infectious disease case conferences, a weekly joint clinical conference with the adult infectious disease group, and a weekly journal club. 

Dr. Granoff and Staff

1. We are employing idiotypic (Id) analysis to investigate the immunoglobulin variable region genes utilized in the antibody response to meningococcal B polysaccharide. We are also investigating the use of anti-Id as possible vaccine candidates. These latter studies utilize both normal mice and the recently described hu-PBL-SCID mouse model in which immunodeficient mice are reconstituted with human lymphocytes to investigate human B cell responses. These studies will determine the feasibility of utilizing anti-Ids to elicit antibody reactive with a polysaccharide that is a very poor immunogen, even when presented as a conjugate with a thymus-dependent carrier. 

Dr. Granoff and Staff

2. Surface Antigens and Mechanisms of Virulence of Haemophilus. Haemophilus influenzae is a cause of meningitis, pneumonia and otitis media. Haemophilus ducreyi is a cause of an ulcerative sexually transmitted disease. We are employing recombinant and immunological approaches to determine the mechanism(s) of virulence of these pathogens. We are also interested in understanding immunity to these organisms with the goal of vaccine development. 

Dr. Manson

3. The Development of the Human B Cell Response to Polysaccharide Antigens. These studies concern the maturation in children of the subclass repertoire and clonal diversity of antibodies produced in response to bacterial polysaccharide (PS) antigens. We are examining V region gene expression using human hybridomas specific for Haemophilus. influenzae type b. Correlates between antibody structure and function will be examined using chimeric antibodies. 

Dr. Shactelford

4. Rapid Diagnosis of Viral Infections. The molecular diagnostics section of the diagnostic virology laboratory is studying the use of the polymerase chain reaction for the diagnosis of viral infections. Current projects include the detection of herpes simplex virus, cytomegalovirus and JC virus on cerebrospinal fluid and parvovirus B19 in blood and amniotic fluid. Future projects will explore other viral infections that are not easily diagnosed using existing methods. 

Drs. Storch, Buller and Staff

5. Role of Mac-1 (CD11b/CD18) in Phagocytosis and Adhesion. Mac-1 is a membrane glycoprotein involved in phagocytosis and adhesion by neutrophils and monocytes. In addition to ligand binding, Mac-1 is involved in second messenger generation during adhesion related functions. We are investigating the mechanism of Mac-1’s role in signal transduction. The results of this work are applicable both to understanding host defense and for the control of neutrophil mediated tissue destruction of inflammatory sites. 

Dr. Graham
**Nephrology**

**A** Clinical Nephrology. This course is designed to provide the student with a wide exposure to all aspects of pediatric renal disease and an opportunity to explore a desired aspect of the field in depth. The student will be an integral part of the Renal Team and as such will see a large number of both inpatients and outpatients. Students will have an opportunity to follow the courses of patients with acute renal disease as well as those with more chronic problems and will help to plan the evaluation and therapeutic management of these patients. Discussions and rounds with the attending staff and fellows emphasize the relationship between clinical problems and the pathophysiology of the underlying disease. These informal teaching sessions are supplemented by more formal sessions. These include renal attending rounds, renal research rounds, and journal clubs which are conducted weekly in conjunction with the Renal Divisions, Barnes and Jewish Hospitals. Attendance at the weekly pediatric grand rounds and pediatric case conferences is encouraged. Students will be required to present one or two in-depth reviews of areas of interest to them either in renal physiology or clinical topics. Dr. B. Cole and Staff

**B** Research.

1. Major interests of the investigator are the study of glomerular and tubular dysfunction in transplant recipients, and the study of growth of patients with chronic renal insufficiency. Dr. B. Cole

2. The laboratory is investigating the roles of complement deficiency in the pathogenesis of glomerulonephritis and the regulation of factor B and its role in glomerular disease. Dr. Ault

3. The laboratory investigates perturbations of epithelial transport in the renal collecting tubule. The major area of study is the compensatory adaptation that occurs in response to loss of functioning nephrons; the goals include identification of cellular mechanisms responsible for adaptation in sodium, potassium, bicarbonate, and water transport. Dr. Vehaskari

4. The molecular biology of the H+ transporter and its abnormalities in acidosis are being investigated. Dr. Nelson

**Neurology**

**A** Clinical Neurology. The student participates as a full member of the neurology service team and is directly responsible for a proportion of the patients on the service under the direction of the senior resident. If the student so chooses, he/she will have the opportunity to take night call every third or fourth night, during which time he/she is responsible for the medical care of the entire unit, as well as for emergency admissions. The student will also see outpatients one day a week, during which time he/she will be able to evaluate outpatient problems.

Students may also elect to spend their elective on the combined consultation-office service. Dr. Rothman and Staff

**B** Research.

1. Research in neuropsychology of higher order motor and spatial functions and related cerebral metabolism. Dr. Deuel

2. Pharmacokinetics and pharmacodynamic interactions of anticonvulsant drugs. Dr. Dodson

3. The use of NMR for quantitation of cerebral blood flow. Dr. Neil

4. Biochemistry of cytoskeletal proteins in developing rat brain and spinal cord. Dr. Noetzel

5. Physiology and pharmacology of central synaptic transmission; biology of anoxic neuronal injury; imaging calcium and pH in neurons. Dr. Rothman

6. Physiology of excitatory synaptic transmission in the mammalian central nervous system. Dr. Yamada

**Newborn Medicine**

**A** Clinical Newborn Medicine. The goal of this course is to provide students with responsibility for caring for newborn infants (who range from normal to acutely ill, to chronically ill) and their families. The physiology of the transition from fetal to extrarenal existence, the pathophysiology of specific diseases, and primary accountability of the student for patient management decisions and procedures will be emphasized. In addition, collaboration with nursing staff and other health care providers in decision-making (especially concerning the viability of individual infants) and family management will be regularly required.
Two students during each rotation will be assigned to the Special Care Nursery at St. Louis Children's Hospital and two students to the Labor and Delivery Services at Barnes and Jewish Hospitals. Students assigned to the St. Louis Children's Hospital Special Care Nursery will also have the opportunity to become involved in the transport of acutely ill infants, while those on the Labor and Delivery Service will routinely be involved in normal newborn care and delivery room management. The student will be expected to rotate patient responsibilities every third night. Dr. Cole and Staff

(B) Research.
1. Molecular and cellular regulation of manganese superoxide dismutase in placenta. Dr. Church
2. (a) Developmental regulation of complement biosynthesis in mononuclear phagocytes; (b) cellular and molecular basis of genetically determined plasma protein deficiencies; (c) molecular regulatory mechanisms of endotoxin and interferon-gamma. Dr. Cole
3. Biology of pain in the newborn infant including behavioral, physiological, biochemical, and neurodevelopmental outcome variables. Dr. Porter
4. Studies include: (a) mechanical and neural mechanisms in regulation of upper airway patency in infants and in an animal model; and (b) pathophysiology of sleep apnea, apneic episodes, and Sudden Infant Death Syndrome in young infants. Dr. Thach
5. Histologic and functional characterization of pulmonary ischemia-reperfusion injury by positron emission tomography. Dr. Hamvas
6. Regulation of expression of gastrointestinal-specific genes using transgenic mice. Dr. Hauft
7. Energy consumption in the pregnant woman and newborn infant measured by stable isotope administration. Dr. Downey
8. Regulation of Expression of Clara Cell secretory protein in lung. Dr. Hackett
9. Cloning and characterization of cDNA encoding, the serine esterase complex (SEC) receptor. Dr. August
10. Regulation of glucose transporter localization and function. Dr. Haney

Pulmonary Diseases
(A) Genetic regulation and ontogeny of the tissue specific expression of complement genes and acute phase proteins as models of inflammation. Dr. Colten

(B) The molecular biology of complement deficiencies and structural analysis of the evolution of complement gene families are investigated. Dr. Wetsel

(C) (1) Cellular and molecular mechanisms of regulation of complement synthesis by mediators of inflammation. Cell and molecular biology techniques are being used to define mechanisms of regulation; and (2) Clinical studies of patients with asthma aimed at understanding the mechanisms of death due to asthma in children. Dr. Strunk

(D) The molecular biology of complement deficiencies: specifically in two human families with deficiency of the second component of complement. Dr. C. Johnson

(E) (1) Factors contributing to sleep hypoventilation during early infancy; (2) central airway mechanics and control in infancy, particularly airways hysteresis and causes of recurrent cyanosis. Dr. J. Kemp

(F) (1) Pulmonary function testing via standard techniques in children and innovative techniques in infants; (2) uses of flexible fiberoptic bronchoscopy and bronchoalveolar lavage in pediatric lung disease; (3) pediatric sleep disorders and the use of polysomnography; (4) pediatric lung transplantation. Dr. G. Mallory, Jr.
Faculty

Harriet B. Speeher Professor and Head of Department

Harvey R. Colten, M.D., Western Reserve University, 1963; M.A. (hon.), Harvard University, 1978. (See Department of Molecular Microbiology.)

Allen P. and Josephine B. Green Professor of Pediatric Neurology

Arthur L. Prensky, M.D., New York University, 1955. (See Department of Neurology and Neurological Surgery.)

Alumni Professor of Pediatrics

Alan L. Schwartz, Ph.D., Case Western Reserve University, 1974; M.D., 1976. (See Department of Pharmacology.)

Professors Emeriti

David Goldring, M.D., Washington University, 1940. (Also Lecturer)

John C. Herweg, M.D., Washington University, 1945.

Lawrence I. Kahn (Health Care Research), M.D., Louisiana State University, 1945.

Jean H. Thurston, M.D., University of Alberta, 1941. (See Department of Neurology and Neurological Surgery.)

Professors

Harish C. Agrawal, Ph.D., Allahabad University, 1964. (See Department of Neurology and Neurological Surgery.)

Dennis M. Bier, M.D., New Jersey College of Medicine, 1966. (See Department of Medicine.)

F. Sessions Cole, M.D., Yale University, 1973. (See Department of Cell Biology and Physiology.)

Louis P. Dehner, M.D., Washington University, 1966. (See Department of Pathology.)

Ruthmary K. Deuel, M.D., Columbia University College of Physicians and Surgeons, 1961. (See Department of Neurology and Neurological Surgery.)

Philip R. Dodge, M.D., University of Rochester, 1948. (See Department of Neurology and Neurological Surgery.)

W. Edwin Dodson, M.D., Duke University, 1967. (See Department of Neurology and Neurological Surgery.)

Dan M. Granoff, M.D., The Johns Hopkins University, 1968. (See Department of Molecular Microbiology.)

Alexis F. Hartmann, Jr., M.D., Washington University, 1951.

James P. Keating, M.D., Harvard University, 1963.

John M. Kissane, M.D., Washington University, 1952. (See Department of Radiology.)

William H. McAlister, M.D., Wayne State University, 1954. (See Department of Radiology.)


David H. Perlmutter, M.D., St. Louis University, 1978. (See Department of Cell Biology and Physiology.)

Stephen H. Polmar, Ph.D., Case Western Reserve University, 1966; M.D., 1967. (See Department of Molecular Microbiology.)

Julio V. Santiago, M.D., University of Puerto Rico, 1967. (See Department of Medicine.)

Gary D. Shackelford, M.D., Washington University, 1968. (See Department of Radiology.)

Penelope G. Shackelford, M.D., Washington University, 1968. (See Department of Molecular Microbiology.)

Carl H. Smith, M.D., Yale University, 1959. (See Department of Pathology.)

Thomas L. Spray, M.D., Duke University, 1973. (See Department of Surgery.)

Arnold W. Strauss, M.D., Washington University, 1970. (See Department of Biochemistry and Molecular Biophysics.)

Robert C. Strunk, M.D., Northwestern University, 1968.

Jessie L. Ternberg, Ph.D., University of Texas, 1960; M.D., Washington University, 1963; Sc.D. (hon.), Grinnell College, 1972. (See Department of Surgery.)

Bradley T. Thach, M.D., Washington University, 1968.

Teresa J. Vietti, M.D., Baylor University, 1953. (See Department of Radiology.)

John B. Watkins, M.D., Case Western Reserve University, 1961.

Professors (Clinical)

Maurice J. Keller, M.D., Columbia University, 1940.

Maurice J. Lonsway, M.D., Washington University, 1950.

James E. Miller, M.D., Medical College of Alabama, 1949. (See Department of Pathology.)

Louis P. Dehner, M.D., Western Reserve University, 1948.

Stephen H. Polmar, Ph.D., Case Western Reserve University, 1966; M.D., 1967. (See Department of Molecular Microbiology.)

Julio V. Santiago, M.D., University of Puerto Rico, 1967. (See Department of Medicine.)

Gary D. Shackelford, M.D., Washington University, 1968. (See Department of Radiology.)

Penelope G. Shackelford, M.D., Washington University, 1968. (See Department of Molecular Microbiology.)

Carl H. Smith, M.D., Yale University, 1959. (See Department of Pathology.)

Thomas L. Spray, M.D., Duke University, 1973. (See Department of Surgery.)

Arnold W. Strauss, M.D., Washington University, 1970. (See Department of Biochemistry and Molecular Biophysics.)

Robert C. Strunk, M.D., Northwestern University, 1968.

Jessie L. Ternberg, Ph.D., University of Texas, 1960; M.D., Washington University, 1963; Sc.D. (hon.), Grinnell College, 1972. (See Department of Surgery.)

Bradley T. Thach, M.D., Washington University, 1968.

Teresa J. Vietti, M.D., Baylor University, 1953. (See Department of Radiology.)

John B. Watkins, M.D., Case Western Reserve University, 1961.

Associate Professor Emeritus

Dorothy J. Jones, M.D., Washington University, 1934.

Associate Professors

Garrett M. Brodeur, M.D., Washington University, 1975. (See Department of Genetics.)

Barbara R. Cole, M.D., University of Kansas, 1967.

Robert P. Foglia, M.D., Georgetown University, 1974. (See Department of Surgery.)


Vita J. Land, M.D., McGill University, 1965.
Benjamin C. P. Lee, M.B.B.S., University of London, 1966. (See Department of Radiology.)

Susan B. Mallory, M.D., University of Texas, 1974. (See Department of Internal Medicine.)

Charles B. Manley, Jr. (Genitourinary Surgery), M.D., University of Missouri, 1958. (See Department of Surgery.)

Jeffrey L. Marsh, M.D., Johns Hopkins University, 1970. (See Department of Surgery.)

Robert S. Munson, Ph.D., University of Connecticut, 1976. (See Department of Molecular Microbiology.)

Michael J. Noetzel, M.D., University of Virginia, 1977. (See Department of Neurology and Neurological Surgery.)

Tae Sung Park, M.D., Yonsei University College of Medicine, 1971. (See Department of Neurology and Neurological Surgery.)

J. Julio Perez Fontán, M.D., Universidad de Santiago, 1977.

Steven M. Rothman, M.D., State University of New York, Upstate, 1973. (See Departments of Anatomy and Neurobiology and Neurology and Neurological Surgery.)

Marilyn J. Siegel, M.D., State University of New York, Downstate, 1969. (See Department of Radiology.)

Paul S. Simons, M.D., Washington University, 1967. (See Health Key Medical Group.)

Gregory A. Storch, M.D., New York University School of Medicine, 1973. (See Department of Medicine.)


V. Matti Vehaskari, M.D., Helsinki University, 1970.

Neil H. White, M.D., Albert Einstein College of Medicine, 1975.

Michael P. Whyte, M.D., State University of New York, Downstate, 1972. (See Department of Medicine.)

Research Associate Professor

Michael L. Landt (Laboratory Medicine), Ph.D., University of Oregon, 1976. (See Department of Pathology.)

Associate Professors Emeriti (Clinical)

Helen M. Aff, M.D., Washington University, 1934. 

Stanley L. Harrison, M.D., Washington University, 1930.

Frederick A. Jacobs, M.D., Washington University, 1928.

Sol Londe, M.D., Washington University, 1927.

Frank S. Wissmath, M.D., Washington University, 1943.

Associate Professors (Clinical)


C. Read Boles, M.D., Washington University, 1943.

James M. Corry, M.D., Washington University, 1974.

Robert H. Friedman, M.D., Washington University, 1948.

Elliot F. Gellman, M.D., University of Missouri, 1961.

Gene H. Grabau, M.D., Washington University, 1942.


Kenneth A. Koerner, M.D., Washington University, 1941.

John C. Martz, M.D., Washington University, 1942.

Homer E. Nash, Jr., M.D., Meharry Medical College, 1951.
Frederick D. Peterson, M.D., Washington University, 1957.
Steven I. Plax, M.D., University of Missouri, 1961.
Warren G. Sherman, M.D., Tulane University, 1969.

Assistant Professors
Burt I. Bromberg, M.D., University of South Alabama, 1981.
Charles E. Canter, M.D., St. Louis University, 1979.
Susan L. Church, M.D., McGill University, 1982.
Cheryl M. Coffin, M.D., University of Vermont, 1980. (See Department of Pathology.)
Berengere M. de Martinville, M.D., Lyon Medical School, 1973. (See Department of Genetics.)
S. Bruce Dowton, M.B.B.S., University of Sydney, 1980. (See Department of Pathology.)

Robert J. Fallon, M.D., New York University, 1980; Ph.D., 1980.
James W. Grant, M.D., Duke University, 1979.
Aaron Hamvas, M.D., Washington University, 1981.
Sherrie M. Hauft, M.D., University of Texas Medical School, Houston, 1984.
Glen L. Hortin, Ph.D., Washington University, 1983; M.D., 1983.
James S. Kemp, M.D., Creighton University, 1976.
Mark E. Lowe, M.D., University of Miami, 1984.
Rodney P. Lusk, M.D., University of Missouri, 1977. (See Department of Otolaryngology.)
George B. Mallory, Jr., M.D., Albert Einstein College of Medicine, 1974.
Harlan R. Muntz, M.D., Washington University, 1977. (See Department of Otolaryngology.)
Jeffrey J. Neil, M.D., Ph.D., Washington University, 1984. (See Department of Neurology.)
Fran L. Porter, Ph.D., Washington University, 1977.
Mabel L. Purkerson, M.D., Medical College of South Carolina, 1956. (See Administration and Department of Medicine.)
Robert J. Rothenbuehler, M.D., University of Chicago, 1976.
C. Jeffrey Sippel, Ph.D., St. Louis University, 1980; M.D., 1983.
Robert Lawrence Tychsen, M.D., Georgetown University, 1979. (See Departments of Anatomy and Neurobiology and Ophthalmology and Visual Sciences.)
Donna A. Wall, M.D., University of Manitoba, 1981.
Michael S. Watson, Ph.D., University of Alabama, 1981. (See Department of Genetics.)
Rick A. Wetsel, Ph.D., University of Texas, San Antonio, 1982. (See Department of Molecular Microbiology.)
Kelvin A. Yamada, M.D., Baylor College of Medicine, 1983. (See Department of Neurology.)

Research Assistant Professors
Max Q. Arens, Ph.D., Virginia Polytechnic Institute and State University, 1971.
Ronald L. Gingerich, Ph.D., Indiana University, 1975. (See Department of Medicine.)

Assistant Professors Emeriti (Clinical)
Martin Calodney, M.D., New York University, 1936.
Samuel W. Gollub, M.D., Washington University, 1941. (See Departments of Pediatrics and Pathology.)
Edith C. Robinson, M.D., The Johns Hopkins University, 1932.
Alfred S. Schwartz, M.D., The Johns Hopkins University, 1936.
Assistant Professors (Clinical)

Denis I. Altman, M.B., B.Ch., University of Witwatersrand, 1975. (See Department of Neurology and Neurological Surgery.)

Jill M. Baer, M.D., University of Kentucky, 1975.

Edward T. Barker, M.D., Washington University, 1957.


Max H. Burgdorf, M.D., Washington University, 1974.

Garrett C. Burris, M.D., Louisiana State University, 1968. (See Department of Neurology and Neurological Surgery.)

John C. Davis, M.D., University of Michigan, 1980.

Tulay Dincer, M.D., Hacettepe University, 1977.

Sandra J. Dodson, M.D., Northwestern University, 1976.


Gerald J. Duling, M.D., St. Louis University, 1959.

Ir J. Friedman, M.D., University of Arkansas, 1960.


James A. Gerst, M.D., University of Missouri, 1972.


J. Larry Harwell, M.D., University of Missouri, 1961.

Robert J. Hoffman, M.D., St. Louis University, 1976.

William L. Johnson, M.D., University of Missouri, 1981. (See Health Key Medical Group.)

Michele E. Kemp, M.D., Washington University, 1981.

Henry I. Knock, M.D., The Johns Hopkins University, 1953.

Jack A. Land, Jr., M.D., University of Mississippi, 1977.

Richard L. Lazaroff, M.D., St. Louis University, 1978.

Stanley B. Lyss, M.D., Washington University, 1962.

Thomas C. McKinney, M.D., Washington University, 1980. (See Health Key Medical Group.)

M. Michael Maurer, M.D., Washington University, 1972.

Kevin J. Murphy, M.D., St. Louis University, 1978.

Paul H. Painter, M.D., St. Louis University, 1947. (See Division of Child Psychiatry.)

Susan Pittman, M.D., University of Missouri, 1963.

James R. Rohrbaugh, M.D., Ohio State University, 1974. (See Department of Neurology and Neurological Surgery.)


William J. Ross, M.D., Washington University, 1972.


Mary A.T. Tillman, M.D., Howard University, 1960.

Abby L. Wasserman, M.D., The Johns Hopkins University, 1970. (See Department of Psychiatry.)

Zila Welner, M.D., Hebrew University, 1961. (See Department of Psychiatry.)

George T. Wilkins, Jr., M.D., University of Illinois, 1957.

Kathleen Winters, M.D., Medical College of South Carolina, 1955. (See Health Key Medical Group.)

Patricia B. Wolff, M.D., University of Minnesota, 1972. (See Health Key Medical Group.)


Instructors

Anna M. August, M.D., University of Alabama, 1986.

Betina H. Ault, M.D., University of Tennessee, 1984.


Antonella Circolo, M.D., University of Perugia, 1978.
Michael T. Connor, M.D., Wayne State University, 1974. (See Department of Anesthesiology.)

Jeffrey G. Dawson, M.D., University of Louisville, 1982.

Catherine J. Doty, M.D., University of Missouri, 1989.


Anna M. Fitz-James, M.D., George Washington University, 1981.

Irene L. Graham, M.D., Baylor College of Medicine, 1982.

Joel B. Gunter, M.D., University of Oklahoma, 1982. (See Department of Anesthesiology.)

Brian P. Hackett, Ph.D., Boston University, 1984; M.D., 1986.

Peter M. Hancy, Ph.D., Case Western Reserve University, 1984; M.D., 1986.


Donald V. Huebner (Dental Medicine), D.D.S., Washington University, 1969. (See Department of Radiology.)

Charles A. C. Johnson, M.B., Ch.B., University of Cape Town, 1975.

Robert M. Kennedy, M.D., Medical College of Georgia, 1980.

Leslie M. Lang, M.D., Ph.D., Washington University, 1986.

Janet B. McGillicuddy, M.D., Michigan State University, 1979; M.A., Northern Michigan University, 1980.

Mark J. Manary, M.D., Washington University, 1982.

Barry P. Markovitz, M.D., University of Pennsylvania, 1983. (See Department of Anesthesiology.)

Jean Pappas Molleston, M.D., Washington University, 1986.


Patricia A. Parsons (Dental Medicine), D.D.S., Washington University, 1957.

R. Mark Payne, M.D., University of Texas, 1983.

Teresa M. Petros, M.D., Loyola University, 1986.

Joan L. Rosenbaum, M.D., University of Texas, Houston, 1983.


Eleanor M. Shaw, M.D., University of Missouri, 1983.

Carol A. Smith, M.D., University of Tennessee, 1988.

Abby L. Solomon, M.D., University of Cincinnati, 1986.

Robert D. Steiner, M.D., University of Wisconsin, 1987.

Mehernoor F. Watcha, M.D., University of Bombay, 1973. (See Department of Anesthesiology.)

B. Craig Weldon, M.D., St. Louis University, 1978. (See Department of Anesthesiology.)

Karen M. Wickline, M.D., St. Louis University, 1986.

Research Instructors

Richard S. Buller, Ph.D., University of Montana, 1983.


Sandra J. Holmes, Ph.D., Washington University, 1989.

Aaron J. Moe, Ph.D., Virginia Polytechnic Institute and State University, 1984.

Instructors (Clinical)

Patricia J. Amato, M.D., Medical College of Ohio, 1982. (See Health Key Medical Group.)

Christos A. Antoniou, M.D., University of Athens, 1958.

Jean M. Auguste, M.D., Medical School of Haiti, 1956.

Bonnie J. Aust, M.D., University of Texas, San Antonio, 1979. (See Health Key Medical Group.)


Miriam J. Behar, M.D., The Johns Hopkins University, 1981. (See Health Key Medical Group.)


Huldah C. Blamoville, M.D., Meharry Medical College, 1965.

Eyla G. Boies, M.D., Washington University, 1978. (See Health Key Medical Group.)

Robert J. Bradshaw, M.D., St. Louis University, 1980.

Tattamangalam P. Chandrika, M.S.B.S., Calicut Medical College, 1973. (See Health Key Medical Group.)

Ray S. Davis, M.D., University of Louisville, 1978.

David P. Dempsher, M.D., Ph.D., The Johns Hopkins University, 1982.

Jay S. Epstein, M.D., Emory University, 1983.

Elliott H. Farberman, M.D., St. Louis University, 1973.

Edward B. Fliesher, M.D., St. Louis University, 1978.

Florentina U. Garcia, M.D., University of the Philippines, 1965.

Melanie K. Gilliam, M.D., University of Louisville, 1981.

Joseph K. Goldenberg, M.D., University of Missouri, Kansas City, 1980.

Roman E. Hammes, M.D., University of Iowa, 1954.


Nancy E. Holmes, M.D., University of Missouri, 1976.

Carl S. Ingber, M.D., Boston University, 1972.


Joyce D. Johnson, M.D., Case Western Reserve University, 1982.


Nancy E. Holmes, M.D., University of Missouri, 1976.

Evelyn L. Graham, M.D., Baylor College of Medicine, 1981.

Richard S. Buller, Ph.D., University of Montana, 1983.


Sandra J. Holmes, Ph.D., Washington University, 1989.

Aaron J. Moe, Ph.D., Virginia Polytechnic Institute and State University, 1984.

Instructors (Clinical)

Patricia J. Amato, M.D., Medical College of Ohio, 1982. (See Health Key Medical Group.)

Christos A. Antoniou, M.D., University of Athens, 1958.

Jean M. Auguste, M.D., Medical School of Haiti, 1956.

Bonnie J. Aust, M.D., University of Texas, San Antonio, 1979. (See Health Key Medical Group.)


Miriam J. Behar, M.D., The Johns Hopkins University, 1981. (See Health Key Medical Group.)
Pamela M. Schuler, M.D., University of Michigan, 1979.
Jeffrey I. Schulman, M.D., University of Kentucky, 1974.
Norman P. Steele, M.D., Indiana University, Indianapolis, 1972.
M. Anne Street, M.D., University of Illinois, 1976.
Roger J. Waxelman, M.D., University of Missouri, 1969.
Marc E. Weber, M.D., University of Tennessee, 1974; J.D., St. Louis University, 1982.

Research Associate
Richard E. Hauhart, M.S., University of Missouri, St. Louis, 1982.

Assistants (Clinical)
Juli A. Antonow, M.D., University of Minnesota, 1975.
Earl C. Becks, Jr., M.D., University of Missouri, 1981.
Marietta O. Belen, M.D., Far Eastern University, 1963.
Jean E. Birmingham, M.D., University of Missouri, 1988.
Sheila D. Boyd, M.D., University of Missouri, Kansas City, 1980.
Earline A. Brownridge, M.D., University of Missouri, 1982.

Rubilinda Q. Casino, M.D., University of Santo Thomas, 1979.
Seth J. Brownridge, M.D., Washington University, 1982.
William T. Chao, M.D., University of Illinois, Chicago, 1979.
Darryl S. Cohen, D.O., Texas College of Osteopathic Medicine, 1981.

Emanuel Rashed, M.D., St. Louis University, 1962.
Martin D. Rudloff, M.D., Washington University, 1981.
Janet M. Ruzycki, M.D., Washington University, 1981.
Howard J. Schlansky, M.D., University of Missouri, Kansas City, 1978.


Katherine L. Kreusser, M.D., Indiana University, 1978.
Norton S. Kronemer, M.D., University of Missouri, 1962.
Clara C. Lagueruela, M.D., Jarvisana University, 1980.
Leland M. Laycob, M.D., University of Missouri, 1968.
Barry Light, Ph.D., University of Missouri, 1977; M.D., 1980.
Robert D. Lins, M.D., University of Missouri, 1969.
David L. Lohmeyer, M.D., University of Missouri, 1977.
John F. Mantovani, M.D., University of Missouri, 1974. (See Department of Neurology and Neurological Surgery.)
Elaine Miller, M.D., Medical College of Alabama, 1949.

Eugenia M. Pierce, M.D., St. Louis University, 1958.
Joseph L. Portnoy, M.D., University of Kansas, 1974.

John P. Galgani, Jr., M.D., St. Louis University, 1982.

Dharam P. GoeL, M.B., B.S., All India Institute of Medical Sciences, 1978.


Kathleen M. Hanlon, M.D., Washington University, 1986.

Thomas P. Harrison, Jr., M.D., University of Missouri, 1979.

Denise R. Johnson, M.D., Loma Linda University, 1984.

Robert S. Kehler, M.D., St. Louis University, 1984.


Margaret A. Martin, M.D., University of Wisconsin, 1986.

Alison C. Nash, M.D., Baylor College of Medicine, 1981.

David A. Nile, M.D., St. Louis University, 1981.

Jerome H. O’Neil, Jr., M.D., St. Louis University, 1981.


Martha A. Papay, M.D., University of Missouri, 1985.

Jennifer S. Quinn, M.D., University of Kentucky, 1986.

Habibur Rahman, M.B., B.S., Dacca University Medical College, 1972.

Catherine R. Remus, M.D., Rush University, 1983.

Carol A. Robinson, M.D., University of Missouri, 1985. (See Health Key Medical Group.)

Isabel L. Rosenbloom, M.D., University of Maryland, 1984. (See Health Key Medical Group.)

Joseph Schachter, M.D., Indiana University, 1979.

Margaret A. Schmandt, M.D., St. Louis University, 1987.

Martin P. Schmidt, M.D., St. Louis University, 1986.


Hsin-Chin Shih, M.D., Kaoshiung Medical College, 1964.

Nareshkumar Solanki, B.M., B.S., University of Nairobi, 1975.

Robert D. Spewak, M.D., St. Louis University, 1979.

Craig A. Spiedel, M.D., Case Western Reserve University, 1982.


Joan L. Warren, M.D., University of Missouri, Kansas City, 1982.
PSYCHIATRY

Instruction in psychiatry is given in the last three years of the medical course. Emphasis is on teaching psychiatry as a medical discipline, including the biological, social, and psychological mechanisms and manifestations of psychiatric illness, as well as psychological reactions to other illnesses. Recognition of current limitations of knowledge combined with an appreciation of what is known leads to a spirit of constructive skepticism. This attitude permits the student to study psychiatry in depth and broadly without preconceived theories.

SECOND YEAR

Introduction to Clinical Psychiatry

This course will emphasize the diagnosis of major psychiatric illnesses. Psychiatric diseases will be described in terms of epidemiology, clinical presentation, natural history, genetics, differential diagnosis and clinical management. Biological and psychological influences on these diseases will be presented. Interviewing techniques and performance of the mental status exam will be demonstrated by occasional patient interviews. Dr. M. Jarvis and Staff

THIRD YEAR

Psychiatry Clerkship

Students in groups of about 15 spend six weeks on the inpatient services of Barnes, Jewish, and Malcolm Bliss Mental Health Center at St. Louis State Hospital. The diversity of clinical settings for student-patient contact provides exposure to patients suffering from a wide variety of psychiatric disorders. Emphasis is upon developing interviewing and mental status examination skills, diagnostic capabilities for major psychiatric illnesses, and preliminary understanding of pharmacologic and behavioral/psychotherapeutic treatment strategies. Dr. Drevets and Staff

FOURTH YEAR

“A” Elective

Psychoanalysis. Introduction to Psychoanalytic Theory and its application to medicine and psychiatry: the psychoanalytic theory of personality will be discussed in a seminar in which the clinical practice aspects of the theory would be related to clinical medicine and psychiatry. A bibliography will be distributed and reading of basic books encouraged. Clinical material will be used to demonstrate the psychoanalytic theory and its applications. Seminars will be held in the Psychoanalytic Institute Building, 4524 Forest Park, Room 10. Dr. A. Kaplan

“B” Electives

(A) Outpatient and Community Psychiatry. This is a flexible clerkship tailored to the student’s interests. Adult psychiatric patients in the Washington University Psychiatric Clinic present a variety of psychological and interpersonal problems similar to those encountered in the office practice of a psychiatrist, an internist, or a family physician. Students have an opportunity to learn a variety of treatment techniques under supervision. Students also manage patients in a community mental health center located in an inner-city area. There, students see how psychiatry works with social agencies, schools, and other institutions utilizing paramedical personnel in the detection and treatment of mental illness. Dr. Smith

(B) Clinical Psychiatry in Barnes Hospital. This is a fourth-year elective providing students with an opportunity to expand their knowledge of inpatient clinical psychiatry by functioning as externs. The student attends all staffing and teaching conferences given to first-year psychiatry residents, takes patients in rotation and may on occasion share night call with other first-year residents, approximately every fifth night. Immediate supervision is provided by the inpatient attending. Teaching emphasis is directed toward psychiatric diagnosis, appropriate use of psychopharmacologic agents, personal and family psychotherapeutic intervention, use of community resources and pursuit of the psychiatric scientific literature. Dr. Rubin

(C) Child Psychiatry, Children’s Hospital Inpatient Unit and Outpatient Clinic. This clerkship in child psychiatry gives students an appreciation of the intricacies of diagnosis and treatment of children and teenagers with psychiatric disorders. The clerkship involves working up a small number of preadolescent and adolescent children under the supervision of senior staff members. Didactic teaching is available, as well as individual supervision of patients. Students gain an appreciation of medication and other treatment modalities. They are exposed to the roles of community agencies, such as juvenile court and welfare agencies, with which a child psychiatrist must work. Students also gain appreciation of the roles of nurse, social worker, teacher, and occupational therapist in collaboration with individuals of these disciplines. Dr. Mattison and Staff

(D) Psychiatry Consult Service. The fourth year student will work closely with the consult resident and consult attending in the evaluation and treatment of patients referred to the psychiatry consult service. The student may attend two inpatient and two outpatient teaching conferences per week in addition to Grand Rounds and Research Rounds. Dr. Dean
(F) Clinical Psychiatry in a Community Mental Health Center - Inpatient Services. The senior course will provide the student with the opportunity to become a key medical member of a psychiatric treatment team dealing with the evaluation of patients in the emergency room; selective admissions of certain cases; diagnosis and management of particular patients. Individual supervision will be provided by the Inpatient Director and supervising psychiatrist instructor in charge of the ward that the student is assigned to. The student shall participate in the teaching sessions arranged for the first year psychiatric residents in training. Dr. Wilson

(F) Substance Abuse Treatment. The rotation gives the student the opportunity to learn about the inpatient treatment of alcohol and licit and illicit drug abuse. Students will be expected to become familiar with the theoretical basis of Relapse Prevention therapy, the conduct of therapy groups, and the medical complications of substance abuse. Students should report to Dr. Lewis' office on the first day of elective. Dr. Lewis

(G) Electroconvulsive Therapy (ECT). The student will be involved in the neuropsychiatric assessment of patients referred for ECT. In addition, the student will receive training in the application of ECT and in the clinical management of patients receiving ECT. Dr. Zorumski

RESEARCH

The Department of Psychiatry has a long and distinguished history of research in the neurobiology, epidemiology and genetic determinants of behavior, basic mechanisms of central nervous system function and psychiatric disturbances. The excellent balance of clinical and biomedical researchers have a strong research focus on alcoholism, drug abuse, behavioral medicine, schizophrenia, affective disorders and other psychiatric disturbances. Studies are currently underway with both human and animal models as well as computer and mathematical modeling. The department has a long-standing commitment to the classification and assessment of psychiatric problems as medical disorders, the development of standardized diagnostic tasks, familial and molecular genetic approaches to understanding the basis of psychiatric syndromes, the epidemiology of drug abuse, alcoholism, affective disorders and schizophrenia and molecular biological approaches to the study of brain-behavior relationships. The Department's research program fosters collaboration within its various sub-units as well as with numerous pre-clinical and clinical departments throughout the medical center. Most of our faculty are interested in providing research opportunities. Below are a few examples:

Our research program focuses on the role of endogenous opioid peptides (EOP) in the control of hypothalamic-pituitary function. We are especially interested in the mechanisms by which EOP influence the release of hypothalamic releasing factors, particularly luteinizing hormone releasing hormone (LHRH), and the role these peptides play in the regulation of spermatogenesis and steroidogenesis in the testes. In addition to our strong interest in the interaction between EOP and the endocrine system we are also examining the influence of abused substances on neuroendocrine function. Our interests fall into two general areas. First, the effects of substances of abuse administered during the prepubescent period on the onset of puberty and sexual maturation. As an integral part of these studies we are also exploring the hypothesis that the maturation of the EOP system represents the "trigger" for the onset of puberty which has thus far eluded identification. Second, we have observed that treatment of male rats with several abused compounds, such as morphine and alcohol, for a brief period of time followed by a drug free period has adverse effects on their male offspring, particularly with respect to their sexual maturation. The mechanisms underlying these potentially important transgenerational effects of substances of abuse are actively under investigation. Our studies involved many levels of analysis: whole animal pharmacology, tissue culture, in vitro superfusion of various organs, biochemical analyses and a variety of other techniques in molecular biology. Dr. Cicero

Our investigations in psychiatric genetics attempt to understand the familial aggregation of the major psychiatric illnesses. We aim to characterize complex mechanisms of transmission and to localize abnormal genes using DNA Restriction Fragment Length Polymorphisms as linkage markers. A broad range of research opportunities are available, such as locating and interviewing families participating in genetic studies and working in a genetics lab. Laboratory techniques include the formation and culture of lymphoblastoid cell lines; DNA extraction; and the detection of DNA polymorphisms. Psychiatric disorders under study include schizophrenia, bipolar manic depressive illness, and alcoholism. Drs. Cloninger & Reich
A research program focusing on schizophrenia and related clinical problems operates at several Washington University Medical Center sites, as well as affiliated units at Malcolm Bliss Mental Health Center. This program is focused on testing hypotheses related to the neurochemical, neuroendocrine, and cognitive consequences of neuroanatomical damage linked to schizophrenia. Functional abnormalities of both the monoamines and the excitatory amino acids have been emphasized in recent hypotheses of the pathogenesis of schizophrenia, with special emphasis given to an interaction between dopamine and glutamate pathways within the limbic system. Further, proposed insults to medical temporal brain structures may account for specific cognitive and neuroendocrine findings in these patients. This program encompasses a set of investigations in inpatients and outpatients with schizophrenia, as well as normal subjects, incorporating basal and dynamic assessments of specific neurochemical and neuroendocrine systems, along with symptom and neuropsychological assessments. The effect of glucocorticoids on cognitive performance is studied in normal subjects as well as patients. The development of animal models for the functional neurochemical abnormalities of interest, as well as a variety of neurochemical assays, are performed in Dr. Csernansky’s laboratory. Drs. Newcomer and Csernansky

Faculty

Head of Department and Wallace Renard Professor
C. Robert Cloninger, M.D., Washington University, 1970; M.D. (hon.), Umea University, Sweden, 1983. (See Department of Genetics.)

Spencer T. Olin Professor
Samuel B. Gauze, M.D., Washington University, 1945. (See Department of Medicine.)

Samuel and Mae S. Ludwig Professor
Theodore Reich, M.D., McGill University, 1963. (See Department of Genetics.)

Professor Emeritus
George E. Murphy, M.D., Washington University, 1952.
Eli Robins, M.D., Harvard University, 1943.
Saul Rosenzweig (Medical Psychology), Ph.D., Harvard University, 1932. (Also Department of Psychology)

Professors
Theodore J. Cicero (Neuropharmacology), Ph.D., Purdue University, 1968. (See Department of Anatomy and Neurobiology.)
Helen Donis-Keller (Genetics), Ph.D., Harvard University, 1979. (See Department of Genetics.)
Richard W. Hudgens, M.D., Washington University, 1956.
Blake W. Moore (Biochemistry), Ph.D., Northwestern University, 1952. (See Department of Biochemistry and Molecular Biophysics.)
John W. Olney, M.D., Iowa University, 1963. (See Department of Pathology.)
Dabereu C. Rao (Biostatistics), Ph.D., Indian Statistical Institute, 1971. (See Department of Genetics and Division of Biostatistics.)
John P. Rice (Mathematics), Ph.D., Washington University, 1975. (See Division of Biostatistics.)
Lee N. Robins (Sociology), Ph.D., Radcliffe College, 1951. (Also Faculty of Arts and Sciences)
William R. Sherman (Biochemistry), Ph.D., University of Illinois, 1955. (See Department of Biochemistry and Molecular Biophysics.)
Brian K. Suarez (Genetics), Ph.D., University of California, Los Angeles, 1974. (See Department of Genetics.)
Richard D. Wetzel (Medical Psychology), Ph.D., St. Louis University, 1974.

Research Professors

Mitchell Taibleson (Mathematics), Ph.D., The University of Chicago, 1962. (Also Faculty of Arts and Sciences)

Professors Emeriti (Clinical)
Margaret C. L. Gildea, M.D., Yale University, 1936.
Sydney B. Maughs, M.D., Washington University, 1935.

Professors (Clinical)
Alex H. Kaplan, M.D., St. Louis University, 1936.
Patricia L. O’Neal, M.D., Washington University, 1948.
Marcel T. Saghir, M.D., American University of Beirut, 1963.

Associate Professor (Emeritus)
Edward H. Kowert, M.D., Washington University, 1943.

Associate Professors
Gregory B. Couch

Associate Professor
Andrew C. Heath (Psychology), D.Phil., University of Oxford, 1983. (See Department of Genetics.)
Collins E. Lewis, M.D., Harvard University, 1971.

Patrick J. Lustman (Medical Psychology), Ph.D., Michigan State University, 1980.

Bruce L. Nock (Neurobiology), Ph.D., Rutgers University, 1980. (See Department of Anatomy and Neurobiology.)


Charles F. Zorumski, M.D., St. Louis University, 1978. (See Department of Anatomy and Neurobiology.)

Research Associate Professor

Associate Professors (Clinical)
John T. Biggs, Jr., M.D., University of Tennessee, 1968.
Jack L. Crouchman, M.D., Kansas University, 1968.
Robert S. Hicks, M.D., University of Arkansas, 1958.

Jay Meyer, M.D., St. Louis University, 1960.
Paul M. Packman, M.D., Washington University, 1963.
Thomas F. Richardson, M.D., Washington University, 1963.
E. Robert Schultz, M.D., Washington University, 1955. (See Department of Neurology and Neurological Surgery.)
James B. Smith, M.D., University of Missouri, 1967.
Harold D. Wolff, M.D., State University of Iowa, 1955.

Assistant Professors
Andrea M. Allan (Pharmacogenetics), Ph.D., State University of New York, 1984.
Linda B. Cottler (Epidemiology), Ph.D., Washington University, 1987.
Wayne C. Drevets, M.D., University of Kansas, 1983.
Terrence S. Early, M.D., Duke University, 1982.
Kenneth E. Freedland (Medical Psychology), Ph.D., University of Hawaii, 1982.
Daniela S. Gerhard, Ph.D., Cornell University, 1982. (See Department of Genetics.)
Keith E. Isenberg, M.D., Indiana University, 1978.
Steven O. Moldin (Medical Psychology), Ph.D., Yeshiva University, 1988.
John Newcomer, M.D., Wayne State University, 1985.
Carol S. North, M.D., Washington University, 1983.
James Russell, M.D., University of Missouri, 1983.
Paul VanEerdewegh (Mathematics), Ph.D., Washington University, 1982.
Research Assistant Professors

Kathleen K. Bucholz (Epidemiology), Ph.D., Yale University, 1986.
Barry A. Hong (Medical Psychology), Ph.D., St. Louis University, 1982.
Paul P. Hipps (Biochemistry), Ph.D., North Dakota State University, 1971.
Yukitoshi Izumi (Neurobiology), M.D., Yamagata University, 1985; Ph.D., 1989.
Lynn H. O'Connor (Neuroendocrinology), Ph.D., Rutgers University, 1983.
Abbas Parsian (Genetics), Ph.D., Western Michigan University, 1986.
Thomas Przybeck (Anthropology), Ph.D., Washington University, 1983.
David Wozniak (Neurobiology), Ph.D., Washington University, 1984.

Assistant Professors Emeriti (Clinical)

Robert M. Bell, M.D., St. Louis University, 1928.
Hyman H. Fingert, M.D., State University of Iowa, 1934.
Reece H. Potter, M.D., Washington University, 1935.

Assistant Professors (Clinical)

Bernardo G. Aleksander, M.D., University of Buenos Aires, 1959. (Malcolm Bliss Hospital)
Ahmad Ardekani, M.D., Pahlavi University, 1974.
Juan C. Corvalan, M.D., Argentina National University, 1965.
Alejandro M. Datuin, M.D., University of Santo Tomas, 1965. (Malcolm Bliss Hospital)
Mary Davis, M.D., Washington University, 1952.

Plaridel C. Deza, M.D., University of Santo Tomas, 1956. (Malcolm Bliss Hospital)
Terry A. Fuller, M.D., Washington University School of Medicine, 1974.
Fred W. Gaskin, M.D., University of Minnesota, 1968.
Frederick G. Hicks, M.D., University of Minnesota, 1981.
Sheldon G. Holstad (Pharmacy), Pharm.D., University of Iowa, 1986. (St. Louis College of Pharmacy)
Natarajan Laks, M.D., University of Madras, 1967. (Malcolm Bliss Hospital)
James R. Mikolajczak, M.D., St. Louis University, 1972.
Mary A. Montgomery, M.D., Northwestern University, 1973.
Eric J. Nuetzel, M.D., St. Louis University, 1976.
James L. Rutherford, M.D., University of Iowa, 1980.
Paul W. Sheffner, M.D., Washington University, 1974.
Reed E. Simpson, M.D., Washington University, 1976. (Malcolm Bliss Hospital)
Wayne A. Styllings, M.D., Washington University, 1975.
Edwin D. Wolfgram, M.D., State University of Iowa, 1959.

Instructors

Jon Dean, M.D., University of Texas, 1987.
Elliot Nelson, M.D., University of Illinois, 1986.
The Division of Child Psychiatry offers a varied teaching program for medical students, residents in psychiatry, and fellows in child psychiatry at St. Louis Children's and Barnes Hospitals. Outpatient services are organized through the Child Guidance Center located at St. Louis Children's Hospital, and inpatient services are provided through two 8-bed psychiatric unit. Active consultation with all medical and surgical units of the hospital is also maintained. Trainees are assigned to these various services, where they participate in diagnostic evaluations and see patients in treatment under supervision.

**Director of the Division of Child Psychiatry**
Blanche F. Ittleson Associate Professor
Richard Mattison (Child Psychiatry), M.D., Cornell University, 1972.

**Professor Emeritus**

**Professor**
Barbara Geller (Child Psychiatry), M.D., Albert Einstein College of Medicine, 1964.

**Associate Professor**
Richard D. Todd (Child Psychiatry), Ph.D., University of Texas, 1977; M.D., 1981.

**Research Associate Professor**
Thomas Vogel (Child Psychology), Ph.D., Illinois School of Professional Psychology, 1981.

**Associate Professor (Clinical)**

**Assistant Professor (Clinical)**
Scott J. Arbaugh, M.D., St. Louis University, 1985.
David M. Connor, M.D., University of Oklahoma, 1983.
Cynthia Florin, M.D., Columbia University, 1984.
David J. Goldmeier, M.D., Washington University, 1982.
Saaid Khojasteh, M.D., Shiraz University, 1981.
F. Timothy Leonberger (Medical Psychology), Ph.D., University of Southern Mississippi, 1986. (Malcolm Bliss Hospital)
Judith A. McGee (Medical Psychology), Ph.D., St. Louis University, 1979. (Malcolm Bliss Hospital)
Virgil L. Malmberg, M.D., University of Missouri, 1978.

**Lecturers**
William H. Masters (Human Sexuality), M.D., Rochester University, 1943; Sc.D. (hon.), Hamilton College, 1973. (See Department of Obstetrics and Gynecology.)

**Professor Emeritus**
Loretta K. Cass Seleski (Medical Psychology), Ph.D., Ohio State University, 1950.

**Assistant Professor Emeritus**
Zila Welner (Child Psychiatry), M.D., Hebrew University Hadassah Medical School, 1961. (See Department of Pediatrics)

**Assistant Professors**
David Corwin (Child Psychiatry), M.D., Michigan State University, 1976.
Research Assistant
Professors
Peter Ambrose (Child Psychology), Ph.D., University of Missouri, 1987.

Assistant Professors (Clinical)
Paul H. Painter (Child Psychiatry), M.D., St. Louis University, 1947. (See Department of Pediatrics.)
Syed Raza (Child Psychiatry), M.D., University of Karachi Pakistan, 1960.

Jagdish Suri (Child Psychiatry), M.D., King George Medical College, 1964.
Abby L. Wasserman (Child Psychiatry), M.D., The Johns Hopkins University, 1970. (See Department of Pediatrics.)

Instructor Emeritus
Louetta Berger (Psychiatric Social Work), M.S.W., Washington University, 1946.

Instructors
Joan Luby (Child Psychiatry), M.D., Wayne State University, 1985.
Kimberli McCallum (Child Psychiatry), M.D., Yale University, 1986.
Barbara S. Silverstein, M.S.W., Washington University, 1981.

Barbara Swarzenski (Child Psychiatry), M.D., Case Western University, 1986.

Research Instructors

Instructor (Clinical)
Michael R. Banton (Child Psychiatry), M.D., St. Louis University, 1985.
Vinod Suri, M.D., Punjab University, 1962. (Hawthorn Children’s Psychiatric Hospital)
RADIOLOGY

The Mallinckrodt Institute of Radiology (MIR) serves as the Department of Radiology, helping guide the consulting physician in the discovery, treatment and, ultimately, the healing of disease. Established in 1930, MIR has played a key role in radiological research, from the development of the first diagnostic test for gallbladder disease to current nonsurgical treatments for gallstones. In 1964, MIR scientists completed building the first cyclotron to be located in a United States medical center. This historic breakthrough led to the development at the Institute of positron emission tomography (PET) in the early 1970s. A second cyclotron was added in the late 1970s, making MIR the only medical institution in the world to house two cyclotrons.

The Institute is located primarily in its own thirteen-story building, but also occupies space in the West Pavilion and Queeny Tower of Barnes Hospital, Barnard Hospital, Wohl Hospital, the Clinical Sciences Research Building, St. Louis Children's Hospital, the East Building on Scott Avenue, and the Forest Park facility. The department provides diagnostic radiology, nuclear medicine, radiation physics, and radiation oncology services to Barnes, Jewish, and Children's hospitals. Occupying more than 320,000 total square feet, the Institute is one of the five largest and most modern radiological centers in the world.

Clinical facilities for the Radiation Oncology Center are located on the ground and first floors of the Institute, in Barnard Hospital, and in the West Pavilion. Therapy equipment consists of advanced 2100 C, 6-100, 20, and 4 MV linear accelerators. Two state-of-the-art simulators and several computers are available for treatment planning. Also available are facilities and sources for both interstitial and intracavitary therapy and advanced equipment for interstitial and external hyperthermia. Remote afterloading devices are utilized for brachytherapy procedures.

The first floor of the Institute houses a film library, the reception and scheduling areas, consulting viewing rooms, and the 150-seat Scarrellino Auditorium.

Seventy-nine examination rooms for diagnostic radiology are available in the Institute, Queeny Tower, West Pavilion, Wohl Hospital, the East Building, and St. Louis Children's Hospital. MIR clinical facilities are located on the second floor (chest and musculoskeletal radiology and computed radiography); third floor (neuroradiology, digital vascular imaging, computed head tomography); fourth floor (gastrointestinal and genitourinary radiology); and the fifth floor (magnetic resonance imaging and computed body tomography). A clinical facility for positron emission tomography (PET) is located on the seventh floor. A comprehensive state-of-the-art interventional radiology section occupies the eighth floor. Cardiovascular radiology and the Division of Nuclear Medicine are located on the ninth floor of the West Pavilion. The tenth floor of the West Pavilion houses ultrasonography and outpatient radiology, including a comprehensive Breast Diagnostic Center. Orthopedic X-ray facilities are located on the eleventh floor of the West Pavilion and in the Wohl Clinic, and there are four radiology examination rooms within the Barnes Emergency Department. In the north wing of Children's Hospital, the first floor houses a complete pediatric radiology facility offering ultrasound, nuclear medicine, computed tomography, magnetic resonance imaging, and cardiac catheterization. The modern features of the Institute include seven CT scanners, eleven digital vascular imaging systems, four positron emission tomography scanners, and five magnetic resonance imaging scanners, and fourteen ultrasound machines.

Sixth floor of the Institute contains the Division of Radiation Sciences which utilizes a PET imaging system and two medical cyclotrons in Barnard Hospital. Additional research facilities are located on the third (hyperthermia) and sixth (physics) floors of Barnard Hospital, the Forest Park facility (cancer biology), the Clinical Sciences Research Building (radiation oncology, radiation sciences, nuclear medicine, and three-dimensional image processing), and the East Building (magnetic resonance imaging and electronic radiology). The Clinical Sciences Research Building also houses sophisticated computer facilities that are utilized for clinical, research, and teaching applications.

Administrative, teaching, and support functions occupy the ninth through twelfth floors of the Institute. As part of the department's community outreach effort, MIR operates a mobile mammography van that visits shopping malls.
The undergraduate teaching program is designed to present both diagnostic and therapeutic radiology to students as part of the clinical clerkship experience. Every effort is made to provide an opportunity to correlate radiographic and clinical findings through interdepartmental conferences, consultations, and group discussions.

**FIRST YEAR**

In their first year, medical students are first introduced to radiology in two separate ways. During the first semester of the gross anatomy course, students are first introduced into the world of radiology. Conferences are given by several members of the Radiology staff in the following areas: neuroradiology, chest, cardiac, bone and joint, and abdominal radiology. These sessions are arranged to coincide with the particular area of the body being studied in the anatomical dissection classes. Conferences are conducted in small groups giving students an opportunity to relate directly with the radiologists. Dr. Gutierrez

The second form of contact with radiology is offered in the form of a five-week elective seminar. This course seeks to reinforce the first semester anatomy experience by relating previously learned anatomical information to radiographic images. Radiologists from different subspecialties moderate these seminars in which students work in small units and present selected radiological topics to the group. Dr. Wilson

**SECOND YEAR**

Twenty hours of lecture are devoted to an introduction to radiology. The majority of the course is devoted to diagnostic radiology including computed tomography, ultrasound, nuclear medicine, and magnetic resonance. Radiation biology and radiation oncology are also introduced. Dr. Molina

**ELECTIVES**

**Research Electives**

Opportunities are available to carry out research in the laboratories under the guidance of the staff in the fields of diagnostic radiology, therapeutic radiology, radiation physics, and nuclear medicine. Dr. Gutierrez

**Summer Oncology Clerkship for First-Year Students**

An eight-week summer clerkship program is available for first-year medical students. The students participate in the clinical activities of the Division of Radiation Oncology and are exposed to the fundamental concepts of cancer biology and clinical radiation therapy in a series of lectures, seminars, and case presentation conferences. They have the opportunity to conduct either laboratory research or clinical investigation under the direction of the staff members of the sections of Clinical Radiation Oncology and Cancer Biology. Dr. Simpson

**FOURTH YEAR ELECTIVES**

**Clerkship in Radiation Oncology**

A four- or six-week elective in which the student has the opportunity to see patients being evaluated and treated in Radiation Oncology. Emphasis is on techniques of cancer diagnosis and localization, selection of therapy, indications for irradiation and techniques on treatment planning, simulation, and irradiation of a variety of tumors. There are several conferences in which students participate, including new case-presentations, a clinical physics conference, a protocol conference, and interdepartmental conferences with the departments of Pediatrics, Obstetrics and Gynecology, Surgery, and Pathology. Drs. Simpson or Perez

**Diagnostic Radiology Electives**

The role of radiology in the solution of clinical diagnostic problems is emphasized in this clerkship. Each student on the rotation will spend one or two weeks on each of two or three subspecialty sections within the department (abdomen, bone and joint, cardiac, chest, neuroradiology, nuclear medicine, pediatric radiology, radiation oncology, and cross-sectional imaging) under the supervision of a senior faculty member. The student will have a chance to observe special procedures and emergency radiological examinations, as well as routine imaging studies.

During the clerkship, the student will spend part of one evening reviewing films in the emergency room with the radiology resident on call. Conferences intended to complement the subspecialty approach to radiology round out this experience. Dr. Gutierrez

Clerkships in diagnostic radiology are also offered at Jewish Hospital. Dr. Lawrence Kotner

**Nuclear Medicine - Clinical**

A four- or six-week elective in which the student will be exposed to the full range of radionuclide imaging techniques, including SPECT and PET, and also to radionuclide therapy. In conjunction with the staff, the student will be responsible for planning and interpreting nuclear medicine studies of patients referred to the department. Emphasis is placed on integration of nuclear medicine data with clinical and radiologic findings. There are daily conferences and scan interpretation sessions. Participation in clinical and laboratory research projects may also be arranged if desired. Dr. B. Siegel

**Nuclear Medicine - Research**

Research projects are available in computer applications, evaluation of new radiopharmaceuticals, and clinical studies. Current computer research includes:
1) development of three-dimensional display software for tomographic positron imaging; 2) development of iterative reconstruction algorithms for tomographic data; 3) application of modern image processing techniques to nuclear medicine images. The student can undertake either practical computer problems, including program and hardware development, or more theoretical, mathematically-based projects. Prior training in calculus and some computer experience are essential for the computer-related research. Dr. Miller

Research opportunities are available in the nuclear medicine positron emission tomography (PET) facilities. The student will participate in one or several of the ongoing study protocols of the nuclear medicine PET research group, and will be exposed to the basic physical, biochemical, and practical aspects of PET. Current research areas include: (1) basic investigations of novel PET techniques for assessment of tissue perfusion and metabolism; (2) clinical studies of the application of established PET techniques to a variety of disease processes; and (3) clinical evaluation of new PET radiopharmaceuticals. Previous laboratory experience is suggested, in order to maximize the student’s benefit from the research program. More independent projects will be available to students with appropriate previous experience in laboratory or clinical investigation, computer image analysis, radiation physics or electronics. Dr. Griffith

Faculty
Elizabeth F. Mallinckrodt
Professor, Head of Department and Director of the Mallinckrodt Institute of Radiology
Ronald G. Evens, M.D., Washington University, 1964. (Also Department of Economics)

Professors
Dennis M. Balfe, M.D., Medical College of Wisconsin, 1975.
Ralph V. Clayman, M.D., University of California, 1973. (See Department of Surgery.)
James P. Crane, M.D., Indiana University, 1970. (See Departments of Genetics and Obstetrics and Gynecology.)
Mokhtar Gado, DMRE, Cairo University, 1960. (See Neurological Surgery.)
Louis A. Gihula, M.D., University of Illinois, 1967.
Robert L. Grubb, Jr. (Radiation Sciences), M.D., University of North Carolina, 1965. (See Neurological Surgery.)
Fred J. Hodges III, M.D., University of Wisconsin, 1946.
R. Gilbert Jost, M.D., Yale University, 1969. (Also School of Engineering and Applied Science, Department of Computer Science)

Daniel K. Kido, M.D., Loma Linda University, 1965.
Philip A. Ludbrook, M.B., B.S., University of Adelaide, 1965. (See Department of Medicine.)
William H. McAlister, M.D., Wayne State University, 1954. (See Department of Pediatrics.)
Bruce L. McClenann, M.D., State University of New York, Upstate, 1967.
Tom R. Miller, Ph.D., Stanford University, 1971; M.D., University of Missouri, 1976.
William A. Murphy, Jr., M.D., Pennsylvania State University, 1971.
Marcus E. Raichle (Radiation Sciences), M.D., University of Washington, 1964. (See Department of Neurology and Neurological Surgery.)
Stuart S. Sagel, M.D., Temple University, 1965.
Gary D. Shackelford, M.D., Washington University, 1968. (See Department of Pediatrics.)
Barry A. Siegel, M.D., Washington University, 1969. (See Department of Medicine.)
Marilyn J. Siegel, M.D., State University of New York, 1969. (See Department of Pediatrics.)

Michel M. Ter-Pogossian (Radiation Sciences), Ph.D., Washington University, 1950. (See Department of Medicine.)
Michael W. Vannier, M.D., University of Kentucky, 1976. (See Department of Surgery, Division of Plastic and Reconstructive Surgery.)
Michael J. Welch (Radiation Sciences), Ph.D., University of London, 1965. (Also Faculty of Arts and Sciences, Department of Chemistry)

Associate Professors
G. James Blaine III, D.Sc., Washington University, 1974. (See Institute for Biomedical Computing.)
Judy M. Destouet, M.D., Baylor College of Medicine, 1975.
John O. Eichling (Radiation Sciences), Ph.D., Washington University, 1970.
Harvey S. Glazer, M.D., Washington University, 1976.
Fernando R. Gutierrez, M.D., University of Valladolid, 1974.
Rexford L. Hill (Computer Sciences), M.S., University of Cincinnati, 1966. (Also School of Engineering and Applied Science, Department of Computer Science)
Robert G. Levitt, M.D., University of California, 1972.
Robert C. McKnight, M.D., Washington University, 1961. (See Department of Medicine.)
Stephen M. Moerlein, Ph.D., Washington University, 1982.
Barbara S. Monsees, M.D., Washington University, 1975.
William J. Powers (Radiation Sciences), M.D., Cornell University, 1975. (See Department of Neurology and Neurological Surgery.)
Henry D. Royal, M.D., St. Louis University, 1974.
William G. Totty, M.D., University of Tennessee, 1975.

Research Associate Professor

Joel S. Perlmutter (Radiation Sciences), M.D., University of Missouri, 1979. (See Department of Neurology and Neurological Surgery.)

Associate Professors (Clinical)

Sumner Holtz, M.D., St. Louis University, 1948.
Noah Susman, M.D., Washington University, 1952.
Philip J. Weyman, M.D., Yale University, 1972.

Assistant Professor Emeritus

Armand Diaz (Technical Administration), R.N., R.T., Havana University School of Medicine, 1948.

Assistant Professors

Joseph A. Borrello, M.D., University of Michigan, 1983.
James A. Brink, M.D., Indiana University, 1984.

Jeffrey J. Brown, M.D., University of California, San Diego, 1983.
DeWitte T. Cross III, M.D., University of Alabama, 1980.
Michael D. Darcy, M.D., Ohio State University, 1979.
Farrokh Dehdashti, M.D., Pahlavi University School of Medicine, 1977.
Edward M. Geltman, M.D., New York University, 1971. (See Department of Medicine.)
Diana L. Gray, M.D., University of Illinois, 1981. (See Department of Obstetrics and Gynecology.)
Robert J. Gropler, M.D., University of Cincinnati, 1981.
Thomas E. Herman, M.D., The Johns Hopkins University, 1975.
Marshall E. Hicks, M.D., University of Kentucky, 1982.

Frederick A. Mann, M.D., Indiana University, 1975.
Paul L. Molina, M.D., University of North Carolina, 1983.
Christopher J. Moran, M.D., St. Louis University, 1974.
William H. Perman (Radiation Sciences), Ph.D., University of Wisconsin, Madison, 1980.
Emily L. Smith, M.D., Washington University, 1968.
Alan J. Tiefenbrunn, M.D., Washington University, 1974. (See Department of Medicine.)
Jerold W. Wallis, M.D., Stanford University, 1981.
Anthony J. Wilson, M.B.Ch.B., Otago University, 1972.
Franz J. Wippold II, M.D., St. Louis University, 1977.
**Radiology**

**Research Assistant Professor**
Sampathkumaran S. Kondapuram (Nuclear Medicine), M.S., McMaster University, 1976. (See Department of Medicine.)

**Assistant Professors (Clinical)**
Edward Cohen, M.D., University of Missouri, 1969.
Enrique Cubillo, M.D., University of Madrid, 1962.
Gene L. Davis, Jr., M.D., University of Virginia, 1972.
Guillermo C. Geisse, M.D., University of Chile, 1965.
Albert M. Hammerman, M.D., Washington University, 1976.
Albert E. Hesker, M.D., University of Missouri, 1964.
Lawrence M. Kotner, Jr., M.D., Washington University, 1968.
Ben R. Mayes, Jr., M.D., Washington University, 1966.
Gary H. Omell, M.D., University of Tennessee, 1967.
Naris Rujanavech, M.D., Faculty of Medicine, Siriraj Hospital, 1972.
Chandrakan C. Tailor, M.B., B.S., Maharaja Sayajirao University of Baroda, 1972.
Christopher G. Ullrich (Adjunct), M.D., SUNY Upstate Medical Center, 1976.

**Instructors**
Gregg A. Baran, M.D., Vanderbilt University, 1987.
Meredith W. Bell, M.D., University of Mississippi, 1988.
Harris Chrysikopoulos, M.D., Washington University, 1986.
Lane A. Deyoe, M.D., University of Connecticut, 1986.
Leeanna Dick, M.D., University of Louisville, 1987.
Robin Frank-Gerszberg, M.D., Albert Einstein College of Medicine, 1987.
Patrick O. Gordon, M.D., University of Pittsburgh School of Medicine, 1988.
Kevin W. McEnery, M.D., Georgetown University, 1986.
Cynthia F. Morrison, M.D., Albert Einstein College of Medicine, 1984.
Peter K. Nelson, M.D., Louisiana State University Medical Center, 1986.
Kurt L. Openshaw, M.D., University of Southern California School of Medicine, 1987.
Tracy L. Roberts, M.D., University of South Carolina, 1986.
Nhan P. Truong, M.D., University of Texas Southwestern Medical Center, 1988.
Thomas M. Vesely, M.D., Mayo Medical School, 1986.
John F. Walsh, M.D., Boston University School of Medicine, 1987. (See Department of Medicine.)

**Research Instructors**
Sally W. Schwarz, M.S., University of Southern California, 1976.

**Instructors (Clinical)**
Stephen F. Albert, M.D., St. Louis University, 1968.
Maryellen Amato, M.D., Case Western Reserve University, 1981.
Charles F. Garvin, M.D., University of Missouri, Kansas City, 1982.
James A. Junker, M.D., St. Louis University, 1979.
Gene W. Spector, M.D., Yale University, 1959.
Jerry Tobler, M.D., Yale University, 1983.

**Research Associates**
Carolyn J. Anderson, Ph.D., Florida State University, 1990.
Pietro R. Biondetti (Adjunct), M.D., Padova University, Italy, 1977.
Carmen S. Dence, M.S., Florida State University, 1972.
Maureen J. Fusselman, M.S., St. Louis University, 1984.
Arjun Godiwani (Adjunct), Ph.D., University of Arkansas, 1971.

O. Clark West, M.D., Washington University, 1986.
Robert C. Wood, Jr., M.D., University of Texas Medical Branch at Galveston 1988.
Radiology

Chun Ma, Ph.D., University of Notre Dame, 1991.
Timothy J. McCarthy, Ph.D., University of Liverpool, 1989.
Thomas K. Pilgram, Ph.D., University of California, Berkeley, 1982.
Tian Zeng-min, M.D., Second Medical College, Shanghai, China, 1976.

Research Assistant

Consultant
Mildred Trotter (Anatomy), Ph.D., Washington University, 1924; Sc.D., (hon.), Western College, 1956; Sc.D., (hon.), Mount Holyoke College, 1960; Sc.D., (hon.), Washington University, 1980. (See Department of Anatomy and Neurobiology.)

DIVISION OF RADIATION ONCOLOGY

Professor and Director
Carlos A. Perez, M.D., University of Antioquia, 1960.

Professors
Bahman Emami, M.D., Tehran University, 1968.
Hsiu-san Lin, M.D., Taiwan University, 1960; Ph.D., The University of Chicago, 1968. (See Department of Molecular Microbiology.)
James A. Purdy (Radiation Physics), Ph.D., University of Texas, 1971.
Joseph L. Roti Roti (Cancer Biology), Ph.D., University of Rochester, 1972.
Teresa J. Vietti (Radiation Oncology), M.D., Baylor University, 1953. (See Department of Pediatrics.)
Todd H. Wasserman, M.D., University of Rochester School of Medicine and Dentistry, 1972.

Associate Professors
Perry W. Grigsby, M.D., University of Kentucky, 1982.
Robert J. Myerson, Ph.D., University of California, 1974; M.D., University of Miami, 1980.
Gilbert H. Nussbaum (Radiation Physics), Ph.D., Harvard University, 1967.
Jeffrey F. Williamson (Radiation Physics), Ph.D., University of Minnesota, 1982.
John Wai-chiu Wong (Radiation Physics), Ph.D., University of New Hampshire, 1974.

Associate Professor Emeritus (Clinical)
A. Norman Arneson, M.D., Washington University, 1928. (See Department of Obstetrics and Gynecology.)
Radiology

Associate Professor (Clinical)
Bruce J. Walz, M.D., Washington University, 1966.

Assistant Professors
Robert E. Drzymala (Radiation Physics), Ph.D., University of Oklahoma, 1977.
Andrei Laszlo (Cancer Biology), Ph.D., University of California, 1981.
Michael A. Mackey (Cancer Biology), Ph.D., University of California, San Francisco, 1987.
Ali S. Meigooni (Radiation Physics), Ph.D., Ohio University, 1984.
Eduardo G. Moros (Radiation Physics), Ph.D., University of Arizona, Tucson, 1990.
Yvonne C. Taylor (Cancer Biology), Ph.D., University of Toronto, 1981.

Instructors
Humberto Fagundes, M.D., Federal University of Rio Grande do Sul, 1981.
Seymour Fox (Computer Sciences), Ph.D., University of Oklahoma, 1977.
Anastasios Georgiou, M.D., University of Southern California, 1988.
Russell L. Gerber (Radiation Physics), M.S., St. Louis University, 1985.
Mary L. Graham, M.D., University of Missouri, Kansas City, 1985.
William B. Harms, Sr. (Radiation Physics), B.S., University of Missouri, 1979.
Karl Wei-Han King, M.D., Washington University, 1985.
Maurice L. King, M.D., Louisiana State University, 1985.
Eric E. Klein, M.S., University of Massachusetts, 1985.
Daniel A. Low (Radiation Physics), Ph.D., Indiana University, 1988.
John W. Matthews, D.Sc. (Computer Sciences), Washington University, 1980.
Jeff M. Michalski, M.D., Medical College of Wisconsin, 1986.
Eric D. Slessinger (Radiation Physics), M.S., St. Louis University, 1986.
Marie E. Taylor, M.D., University of Washington, Seattle, 1982.

Instructor (Clinical)
Gary A. Ratkin, M.D., Washington University, 1967. (See Department of Medicine.)

Research Associates
Ming-shun Chen (Cancer Biology), Ph.D., Kansas State University, 1991.
Prabhat Goswami (Cancer Biology), Ph.D., Gauhati University, 1983.
ZuoFeng Li (Radiation Physics), D.Sc., Washington University, 1989.
Di Yan (Radiation Physics), Ph.D., Washington University, 1989.
Xiafang Zhang (Cancer Biology), M.D., Shanghai Medical University, 1968.

Research Assistants
William D. Wright (Cancer Biology), B.S., University of California, 1976.
SURGERY

The Department of Surgery includes cardiothoracic surgery, general surgery, orthopedic surgery, pediatric surgery, plastic surgery and urologic surgery. The formal instruction begins in the second year with an introductory course designed to provide the student with an understanding of the clinical and research characteristics of general surgery and the surgical specialties.

In the third year, students are assigned clinical clerkships where they have an opportunity to participate in the care of surgical patients. The clerkship lasts for twelve weeks and is spent at one or more of the hospitals in the Washington University Medical Center. Students attend daily patient rounds with the house staff and attending staff. Seminars and teaching conferences are scheduled on a regular basis.

In the fourth year, students may select a subinternship or an elective, most of which are for periods of six to eighteen weeks. During the subinternship or preceptorship, the student is assigned to a staff member for instruction in the diagnosis and management of surgical problems. Electives are available in pediatric surgery, thoracic and cardiovascular surgery, orthopedic surgery, urologic surgery, oncologic surgery, transplantation surgery and emergency room surgery.

SECOND YEAR

Introduction to Surgery
This course consists of 6 two-hour lectures in general surgery, cardiothoracic surgery, plastic surgery, urologic surgery, orthopedic surgery and pediatric surgery. The surgical faculty presents the lectures which are designed to familiarize the student with the clinical and investigative opportunities of the various surgical disciplines.

THIRD YEAR

Surgical Wards
The majority of this 12-week course is devoted to general surgery. Students are assigned to rotations at either Barnes Hospital or Jewish Hospital. Students are active participants in the care of assigned patients. Formal conferences consist of case presentations to the faculty, core lectures in surgical pathophysiology, ward rounds, and departmental and divisional rounds.

FOURTH YEAR

The fourth-year students are offered clinical rotations either as subinternships or electives.

Surgical Preceptorships and Subinternships
Each student is assigned to a senior general surgeon. The student sees patients in the clinic and takes case histories, performs physical examinations, and follows patients admitted to the hospital. Dr. Wells

Cardiothoracic Surgery Elective
The senior elective in Cardiothoracic Surgery is a six-week clinical rotation. Students have the choice of spending the entire six weeks in adult cardiac surgery, adult non-cardiac thoracic surgery, or in pediatric cardiac surgery. If the student wishes, the six-week rotation can be divided into any combination of the above three sub-rotations. While on the Cardiothoracic Surgery Service, students will round daily with the Cardiothoracic Surgery House Staff, participate in operative procedures of their choice, attend weekly Cardiac Catheterization Conference (combined Cardiology and Cardiothoracic Surgery), and attend teaching rounds. Students are also encouraged to spend time with the cardiopulmonary bypass team and to participate actively in postoperative care in the 2300 Intensive Care Unit. Dr. Cox and Staff

Critical Care—Burns Elective
In this elective, the student will serve as a regular active member of the Trauma, Burns and Critical Care Service. He or she will be involved with the comprehensive hospital management of the patient with severe burns or trauma. He or she will be active in the Emergency Department, the Operating Room, the Burn Trauma Intensive Care Unit and the Trauma and Burn Convalescent Division. Practical experience will be obtained in resuscitation and shock management, hemodynamic monitoring, ventilatory evaluation and support, nutrition support, surgical infec-
Emergency Surgery Elective

The elective provides the student with an intensive experience in the evaluation and management of a wide variety of medical and surgical emergencies. Students work closely with the Emergency Department attending physicians and senior housestaff. As much as possible, students are allowed flexibility in scheduling and may choose to be on duty in either 24-hour or 12-hour blocks for approximately 72 hours per week. Students will participate in regular Emergency Department conferences as well as a weekly meeting with the Course Director. Final grade will be based on evaluations from Emergency Department attending staff, senior housestaff and the Course Director. Dr. Bessey and Staff.

General Surgery Elective

Each student will be assigned to the general surgery resident ward and will function as a member of the team, sharing most of the duties of an intern. The student will share night call under supervision of first and second year residents in rotation with the ward interns. In addition, part of the elective may be taken in the Surgical Intensive Care Unit. The purpose of this portion of the elective is to familiarize the student with the care of the critically ill surgical patient. Rounds are made every morning with faculty members from the Department of Surgery and a senior surgical resident. Students are encouraged to participate actively in these rounds. They are also encouraged to read about the problems they encounter and to participate as integral members of the team providing care for the patients. Dr. Anderson and Staff.

Jewish Hospital Clerkship

The senior clerkship at Jewish Hospital is an extremely flexible program. Within the framework of providing a good background in and experience with surgical diseases, many approaches are allowable. A student may divide the six weeks here choosing some time on a subspecialty or spending all of the rotation as a surgical subintern. Preceptorships with the attending staff are available and have been popular. Dr. Philpott and Staff.

Organ Transplantation Elective

The care of transplantation patients requires the integration of multiple diverse medical and surgical disciplines. This elective clerkship in organ transplantation encompasses preoperative cadaveric and living related donor evaluation for adult and pediatric recipients of kidney, liver and pancreatic grafts as well as associated operative procedures in patients with end organ failure. Emphasis is placed on postoperative care, multimodality immunosuppression, management of allograft rejection and organ retrieval and preservation. Basic hepatic, pancreatic and renal physiology, fluid and electrolyte balance, operative techniques and transplantation immunology are stressed. Management of the complications of diabetes, portal hypertension and infectious diseases are a part of the complete management of these patients. This course is designed to offer the student an overview of the field of organ transplantation. The student functions as an integral part of the transplant team and assumes appropriate responsibilities under supervision. A vigorous and varied clinical schedule should be anticipated. An interview is recommended prior to selecting this elective. Dr. Anderson and Staff.

Orthopedic Hand Surgery Elective

A clinical elective will be available for a 4-week period, during which time the student will work with attending surgeons primarily at Barnes Hospital. Activities will include participation in the care of hospitalized inpatients, participation in outpatient procedures, attendance at designated attending office hours, attendance at designated orthopedic conferences, and dissection of upper extremity anatomical specimens. Dr. Manske and Staff.

Orthopedic Spine Surgery Elective

This clinical elective is available for a 6-week period. Students will work with attending surgeons and senior residents at Barnes Hospital and St. Louis Children’s Hospital. Participation will include evaluation and management of in-patients and out-patients, serving as an assistant on anterior and posterior spinal decompressions and instrumentations. Dr. Bridwell.
Orthopedic Surgery Elective

The orthopedic clerkship is no longer chosen through the lottery. This clinical elective is available for 4 weeks during which time the student will participate in orthopedic conferences, out-patient clinics, surgical cases, and patient rounds. The student must be a subintern in all departments, and attendance at and participation in the weekly orthopedic conference activities are required. The student will perform as an active and integral part of the orthopedic team. Dr. Strecker

Clerkships are offered on one of seven orthopedic clinical rotations:

1) Barnes Hospital-Hand (Paul R. Manske, M.D.)
2) Barnes Hospital-Trauma (Clayton R. Perry, M.D.)
3) Barnes Hospital-Reconstructive (Charles J. Sutherland, M.D.)
4) St. Louis Regional Medical Center (Richard Pearson, M.D.)
5) John Cochran VA Hospital (Gary A. Miller, M.D.)
6) St. Louis Children's Hospital (Perry L. Schoenecker, M.D.)
7) St. Louis Shriners Hospital for Crippled Children (Perry L. Schoenecker, M.D.)

Orthopedic Trauma Elective

Clinical elective available for a 4-6 week period, during which time the student will work in orthopedic trauma primarily at Barnes Hospital and St. Louis Regional Medical Center. Activities will include participation in the care of hospitalized in-patients, participation in in-patient and out-patient procedures, attendance at designated orthopedic conferences, and participation in ongoing research projects. Dr. Perry

Pediatric Orthopedic Surgery Elective

Clinical elective available for 4 weeks during which time the student will work with attending surgeons primarily at St. Louis Shriners and Children's Hospitals observing and assisting in out- and in-patient care. To be included are activities in the operating room, emergency room and out-patient clinics. Attendance at and participation in the weekly pediatric orthopedic conference activities are required. Dr. Schoenecker

Pediatric Surgery Elective

The student will fully participate as a subintern in all aspects of pediatric surgical patient care, including preoperative evaluation, surgery and postoperative care. Twice daily rounds are made with the resident staff and daily rounds with the attending staff. Participation in general surgery pediatric clinic, emergency room care, pediatric oncology conference and weekly conference in pediatric surgical conditions, as well as daily contact with Pediatric Radiology, are expected. Students are encouraged to undertake clinical investigations if elective time permits. Dr. Foglia and Staff

Plastic and Reconstructive Surgery Elective

The period on plastic surgery may either be spent as a clinical clerk or conducting a basic laboratory project. The purpose of the clinical clerkship is to familiarize the student with the basic principles of tissue repair and reconstruction. The student will have successive assignments to each of the attending staff and the ward resident during the six weeks. This will provide exposure to the breadth and depth of plastic surgery. The student will assume an active role on the plastic surgery service and will participate in the total management of a wide variety of surgical problems including congenital anomalies, head and neck cancer, surgery of the upper extremity, cosmetic and reconstructive plastic surgery. The research clerkship will be conducted in the Plastic Surgery laboratory in association with any or our attending staff. A project will be designed with the student prior to his/her rotation on Plastic Surgery so that all the materials and methods will be available by the beginning of the rotation. Ongoing projects include: 1) nerve repair and regeneration; 2) the effects of growth factors on wound healing; 3) fabrication of body parts using tissue flaps and peptide growth factors; 4) in vivo tissue generation and tissue differentiation; 5) the mechanical, structural and biochemical effects of stress on scar tissue maturation; 6) in vivo anatomy of craniofacial deformities and 7) microvascular thoracic and abdominal research. Dr. Weeks and Staff

St. Louis Regional Medical Center Elective

Students work under the supervision of the chief resident in Surgery and are integral members of the surgical team. Ward rounds are made twice daily. Students are assigned new patients for complete history and physical examinations and are expected to formulate a plan of diagnosis and treatment. Students assist in the operating room on their patients as well as at the direction of the chief resident. Students attend the weekly teaching conference at 8:15 a.m. on Tuesdays and the Mortality and Morbidity Conference held on alternate weeks, and attend the General Surgery Conferences at Barnes Hospital as well. Night call is shared with a surgical assistant resident. Dr. Monaco

Urology Elective

A six-week clinical clerkship in Pediatric and/or Adult Urology will offer the interested student experience with a spectrum of problems in clinical urology. The student will learn the basic diagnostic procedures and management of surgical and nonsurgical aspects of patient care on the private and ward services under the supervision of the attending staff and house officers. Clinical conferences are held four days per week and pyelogram conferences are held daily. Dr. Catalona and Staff
Faculty

Bixby Professor of Surgery, Chairman, Department of Surgery
Samuel A. Wells, Jr., M.D., Emory University, 1961.

 DIVISION OF CARDIOTHORACIC SURGERY

Evarts A. Graham Professor of Surgery and Head of Division
James L. Cox, M.D., University of Tennessee, 1967.
John M. Shoenberg Professor of Cardiovascular Surgery
Nicholas T. Kouchoukos, M.D., Washington University, 1961. (Jewish Hospital)

Professors

Thomas B. Ferguson, Sr., M.D., Duke University, 1947.
G. Alexander Patterson, M.D., Queen's University, Kingston, Ontario, 1974.
Charles L. Roper, M.D., University of Colorado, 1953.

Associate Professors


Associate Professor (Clinical)

Martin Bergmann, M.D., Washington University, 1945. (Jewish Hospital)

Assistant Professors

Caroline M. Dresler, M.D., University of Colorado, 1980.
T. Bruce Ferguson, Jr., M.D., Washington University, 1979.

Charles B. Huddleston, M.D., Vanderbilt University, 1978.
Michael Rosenbloom, M.D., New York University, 1981.

Research Assistant Professor

Richard B. Schuessler, Ph.D., Clemson University, 1977.

Instructors

Christina C. Pasque, M.D., University of California, Los Angeles, 1980.

 DIVISION OF GENERAL SURGERY

Head of Division
Samuel A. Wells, Jr., M.D., Emory University, 1961.

Harry Edison Professor of Surgery
Gordon W. Philpott, M.D., Washington University, 1961. (Jewish Hospital)

Professors Emeriti

Eugene M. Bricker, M.D., Washington University, 1934.
J. G. Proebstein, M.D., Loyola University, 1917.

Professors

Charles B. Anderson, M.D., Yale University, 1962.
M. Wayne Flye, M.D., University of North Carolina, Chapel Hill, 1967; Ph.D., Duke University, 1980. (See Department of Molecular Microbiology.)
Thalachallour Mohanakumar, Ph.D., Duke University, 1974. (See Departments of Medicine and Pathology.)
William W. Monafo, Jr., M.D., Tufts University, 1957.

David W. Scharp, M.D., Washington University, 1970.
Gregorio A. Sicard, M.D., University of Puerto Rico, 1972.

Research Professors

Allan D. Callow, M.D., Harvard Medical School, 1942; Ph.D., Tufts University, 1952.
Una S. Ryan, Ph.D., Cambridge University, 1968. (See Departments of Cell Biology and Physiology and Medicine.)

Associate Professors

Palmer Q. Bessey, M.D., University of Vermont, 1975.
Robert D. Fry, M.D., Washington University, 1972. (Jewish Hospital)
Ira J. Kodner, M.D., Washington University, 1967. (Jewish Hospital)
Richard G. Sisson, M.D., Yale University, 1946. (Jewish Hospital)

Research Associate Professor

William G. Dilley, Ph.D., University of California, 1970.

Associate Professors Emeriti (Clinical)

Richard V. Bradley, M.D., Washington University, 1952.
Leo A. Sachar, M.D., Washington University, 1940. (Jewish Hospital)

Associate Professors (Clinical)

Kenneth J. Bennett, M.D., Tulane University, 1965. (Jewish Hospital)
William D. Shieber, M.D., Washington University, 1953. (Jewish Hospital)
Richard G. Sisson, M.D., Yale University, 1946. (Jewish Hospital)
**Assistant Professors**


L. Michael Brunt, M.D., The Johns Hopkins University, 1980.

James W. Fleshman, Jr., M.D., Washington University, 1980.

Martin D. Jendrisak, M.D., Ohio State University, 1978.

William G. Kraybill, M.D., University of Cincinnati, 1969.

Marvin J. Lopez, M.D., Universidad Autonoma de Guadalajara, Mexico, 1970.

Christopher S. McCullough, M.D., University of Virginia, 1978.

Jeffrey F. Moley, M.D., Columbia University, 1980.

Brian G. Rubin, M.D., University of Vermont, 1984.


Nathaniel J. Soper, M.D., University of Iowa, 1980.

E. Steven Woodle, M.D., University of Texas, Galveston, 1980.

**Research Assistant Professor Emeritus**

Harry W. Margraf, Ph.D., Polytechnicum Milan, 1943; Sc.D., Washington University, 1971. (Jewish Hospital)

**Research Assistant Professors**

Judith M. Connett, Ph.D., Washington University, 1979. (Jewish Hospital)

Phillip Gambel, Ph.D., Pennsylvania State University, 1980.

Martin J. Mangino, Ph.D., Michigan State University, 1985.

**Assistant Professors (Clinical)**


Alvin Goldfarb, M.D., Washington University, 1943. (Jewish Hospital)


Stanley L. London, M.D., Washington University, 1949. (Jewish Hospital)


Shale M. Rifkin, M.D., Washington University, 1948. (Jewish Hospital)

Andrew D. Spencer, M.D., Indiana University, 1954.

**Instructor Emeritus**

George C. Wee, M.D., University of Louisville, 1951.

**Instructor**

Jeffrey M. Reilly, M.D., Dartmouth University, 1985.

**Research Instructor**

Yael G. Alevy, Ph.D., Albert Einstein College of Medicine, 1975.

**Instructors (Clinical)**


Charles R. Berryman, M.D., University of South Alabama, 1978.


Steven W. Cooley, M.D., Louisiana State University, 1977.

Mitchell B. Cordover, M.D., University of Arizona, 1982.

Gary L. Gambill, M.D., University of Oregon, 1974.

Ronald J. Gaskin, M.D., Washington University, 1970.


Jay W. Haines, M.D., Chicago Medical School, 1974.


Elizabeth Hilliker, M.D., Washington University, 1970.

John D. Hirsch, M.D., Washington University, 1973. (Jewish Hospital)

Ronald Kinzleder, M.D., University of Missouri, 1976.

Robert J. Kingsbury, M.D., University of Michigan, 1960.


Eric H. Lindenblad, M.D., University of Missouri, 1981.


Hubert S. Mickel, M.D., Harvard University, 1962.

Julian C. Mosley, Jr., M.D., Washington University, 1972.

George A. Oliver, M.D., Washington University, 1952.


Jon Peterson, M.D., University of Southern California, 1978.

Gary Quick, M.D., University of Pittsburgh, 1972.

Frank O. Richards, M.D., Howard University, 1947. (Jewish Hospital)

Donald C. Sauer, M.D., Washington University, 1960. (Jewish Hospital)


Marys E. Schuh, M.D., Washington University, 1979. (Jewish Hospital)

David Siroospour, M.D., Shiraz University, Iran, 1967.


**DIVISION OF ORTHOPEDIC SURGERY**

Fred C. Reynolds Professor and Head of Division

Paul R. Manske, M.D., Washington University, 1964. (See Irene Walter Johnson Institute of Rehabilitation.)

**Professor Emeritus**

Lee T. Ford, M.D., University of Tennessee, 1940.
**Associate Professors**

Keith H. Bridwell, M.D.,
Washington University, 1977.

Clayton R. Perry, M.D., St. Louis University, 1977.

Ferry L. Schoenecker, M.D.,
University of Wisconsin, 1968.

William B. Strecker, M.D.,
St. Louis University, 1975.

**Associate Professors Emeriti (Clinical)**

Marshall B. Conrad, M.D.,
Washington University, 1945.

Harry C. Morgan, M.D.,
Stanford University, 1953.

**Assistant Professor Emeritus**

J. Otto Lottes, Ph.G.,
St. Louis College of Pharmacy, 1928; M.D.,
University of Louisville, 1937.

**Assistant Professors**

Jerome J. Gilden, M.D.,
Washington University, 1952.

Robert A. Shively, M.D.,
University of Illinois, 1969.

Charles J. Sutherland, M.D.,
Yale University, 1971.

**Research Assistant Professors**

Kenton N. Fedde, Ph.D.,
The University of Chicago, 1983.

Jeffrey H. Owen, Ph.D.,
University of Arizona, 1979.

Leo A. Whiteside, M.D.,
University of Texas Southwestern Medical School, 1969.

**Assistant Professors (Clinical)**

Jordon H. Ginsburg, M.D.,
University of Illinois, 1972. (Jewish Hospital)

Robert E. Kuhlman, M.D.,
Washington University, 1956.

Marvin R. Mishkin, M.D.,
University of Illinois, 1955. (Jewish Hospital)

**Instructors**

Richard E. Hulsey, M.D.,
University of Missouri, Columbia, 1983.

Enes M. Kanlic, M.D.,
University of Sarajevo, 1971.

Lawrence G. Lenke, M.D.,
Northwestern University, 1986.

Gary A. Miller, M.D.,

Richard L. Pearson, M.D.,
University of Illinois, Chicago, 1974.

Donald L. Pruitt, M.D.,
New Jersey Medical School, 1983.

**Research Instructor**

Donald E. Gayou, Ph.D.,
Iowa State University, 1979.

**Instructors (Clinical)**

Donald R. Bassman, M.D.,
Washington University, 1975. (Jewish Hospital)

Donald H. Brancato, M.D.,
Northwestern University, 1967.

William S. Costen, M.D.,
Washington University, 1954.

James P. Emanuel, M.D.,
Washington University, 1983. (Jewish Hospital)

Ronald C. Hertel, M.D.,
Washington University, 1956. (Jewish Hospital)

Barrett K. Holder, M.D.,
Washington University, 1969.

Robert S. Kramer, M.D.,
Washington University, 1983. (Jewish Hospital)

Robert C. Lander, M.D.,
University of Illinois, 1972.

W. Edward Lansche, M.D.,
Washington University, 1952.

Charles I. Mannis, M.D.,
University of Missouri, 1969. (Jewish Hospital)

Alan H. Morris, M.D.,
University of Illinois, 1963. (Jewish Hospital)

Margaret M. Oakley, M.D.,
St. Louis University, 1959. (Shriners Hospital for Crippled Children)

Jerome G. Piontek, M.D.,
St. Louis University, 1979.

Barry L. Samson, M.D.,
Washington University, 1974. (Jewish Hospital)

John J. Sheridan, M.D.,
Washington University, 1969. (Shriners Hospital for Crippled Children)

Keith R. Swanson, M.D.,
University of Texas, Galveston, 1971. (Shriners Hospital for Crippled Children)

Michael H. Winer, M.D.,
University of Illinois, 1968. (Jewish Hospital)

**Assistants (Clinical)**

John P. Arnot, M.D.,
Yale University, 1958.

Kyu Sop Cho, M.D.,
Yon-Sei University, 1954.

**DIVISION OF PEDIATRIC SURGERY**

Head of Division

Robert P. Foglia, M.D.,
Georgetown University, 1974.

**Professor**

Jessie L. Ternberg, Ph.D.,
University of Texas, 1950; M.D.,
Washington University, 1953; Sc.D.,
(On.), Grinnell College, 1972. (See Department of Pediatrics.)

**Associate Professor**

Jacob C. Langer, M.D.,
University of Toronto, 1980.

**DIVISION OF PLASTIC AND RECONSTRUCTIVE SURGERY**

Head of Division

Paul M. Weeks, M.D.,
University of North Carolina, 1958. (See Irene Walter Johnson Institute of Rehabilitation.)

**Professor Emeritus**

Minot P. Fryer, M.D.,
The Johns Hopkins University, 1940; D.S.C.,
Brown University, 1972.
Professors
Susan E. Mackinnon, M.D., Queen's University, Kingston, Ontario, 1975.
Jeffrey L. Marsh, M.D., The Johns Hopkins University, 1970. (See Department of Pediatrics.)
V. Leroy Young, M.D., University of Kentucky, 1970.

Associate Professor
Donald V. Huebener, D.D.S., Washington University, 1969; M.S., Case Western Reserve University, 1971.

Assistant Professors
Mark E. Beehner, D.D.S., Loyola University, 1979; M.D., St. Louis University, 1990.
Thomas J. Francel, M.D., University of Cincinnati, 1982.
George J. Hruza, M.D., New York University, 1982. (See Department of Medicine.)
Timothy R. Jones, M.D., University of Oklahoma, 1983.
Roger K. Khouri, M.D., American University of Beirut, 1981.
Michael W. Vannier, M.D., University of Kentucky, 1979. (See Department of Radiology.)

Instructors
John J. Iacobucci, M.D., University of Michigan, 1982.
Jane A. Riolo, M.D., University of Missouri, 1985.
Marlene B. Salas-Provance, Ph.D., University of Illinois, 1990.

Instructors (Clinical)
David A. Caplin, M.D., University of Cincinnati, 1975. (Jewish Hospital)
Bruce I. White, M.D., Washington University, 1964. (Jewish Hospital)

Robert A. Young, M.D., Ohio State University, 1978.

DIVISION OF UROLOGIC SURGERY
Head of Division
William J. Catalona, M.D., Yale University, 1968.

Professors
Ralph V. Clayman, M.D., University of California, San Diego, 1973. (See Department of Radiology.)
Charles B. Manley, Jr., M.D., University of Missouri, 1958. (See Department of Pediatrics.)

Professor Emeritus (Clinical)
Morris Abrams, M.D., University of Illinois, 1937. (Jewish Hospital)

Professor (Clinical)
Robert K. Royce, M.D., Washington University, 1942.

Associate Professor

Research Associate Professor
Timothy L. Ratliff, Ph.D., University of Arkansas, 1977. (See Department of Pathology.) (Jewish Hospital)

Associate Emeritus Professor (Clinical)
M. Richard Carlin, M.D., Yale University, 1947.

Associate Professors (Clinical)
William T. Bowles, M.D., Stanford University, 1955.

Assistant Professors
Joseph W. Basler, M.D., University of Missouri, 1984.
M’Liss A. Hudson, M.D., University of Texas, 1982.
Carl G. Klutke, M.D., University of Michigan, 1983.

Assistant Emeritus Professor (Clinical)
Franz U. Steinberg, M.D., University of Berne, 1938. (See Department of Medicine.)

Assistant Professors (Clinical)
Lawrence M. Aronberg, M.D., Washington University, 1936. (Jewish Hospital)
James G. Bucy, M.D., Northwestern University, 1962.
Richard P. Parsons, M.D., Washington University, 1958.

Instructors
Charles H. Nicolai, M.D., Washington University, 1946.

Instructors (Clinical)
Saul Klein, M.D., Syracuse University, 1959. (Jewish Hospital)
Neal Neuman, M.D., St. Louis University, 1971. (Jewish Hospital)
Enrique P. Perinetti, M.D., National University of Cuyo, Argentina, 1968.
Courtney Shands III, M.D., Vanderbilt University, 1982.
Herbert Sunshine, M.D., Washington University, 1954. (Jewish Hospital)
Ralph J. Torrence, M.D., Georgetown University, 1980.
TEACHING AND RESEARCH DIVISIONS

GRADUATE PROGRAMS
TEACHING AND RESEARCH DIVISIONS

DIVISION OF BIOSTATISTICS

The Division of Biostatistics is a medical school-wide facility that engages in teaching, research, and biostatistical consultation activities. A course given in the first trimester of the first year, Introduction to Biostatistics, affords a basis for understanding quantitative assessment in biology and medicine, and prepares the student for critical evaluation of reports in the medical literature. Interested students may pursue more intensive studies through electives offered by the Division. At the initiative of other departments, the Division also offers additional short courses in biostatistics. The Division participates actively in both pre- and post-doctoral training. In addition to the core research program of the Division, its research activities include collaborative projects with various departments of the School. Biostatistical consultation represents a major activity of the Division, providing expertise in both theoretical and applied areas.

FIRST YEAR

Introduction to Biostatistics

This introduction to the principles and methods of biostatistics emphasizes the concepts of statistical methodology and the appropriate design of clinical research projects as being essential to the proper application and interpretation of statistical methods and to a critical evaluation of the medical literature. Elementary statistical techniques illustrating the use of statistical principles in experimental and clinical research are discussed. Clinical summaries often precede the biostatistical lectures, highlighting the relevance of certain statistical principles. Small group discussions are also organized on prechosen topics to better prepare the students in evaluating published medical reports. Drs. Schechtman and Spitznagel

ELECTIVES

Biostatistics for Research Workers

This course is designed for those researchers who want to expand their knowledge of practical methods in statistics. It is oriented toward statistical and epidemiological concepts, applications, practical hints, and a hands-on approach to data, rather than theory or derivation of formulas. Heavy use is made of SAS/PC (a statistical analysis package for the PC computer, which is required for this course) for in-class examples and homework problems. The course begins with a basic overview of common statistical techniques, including: simpler, classical methods (e.g., t-test, chi-square, correlation); multivariate methods (regression, logistic models, ANOVA, survival analysis); and study design. These plus other selected topics (e.g., reliability, factor analysis, survey and sampling, research design) are then covered in greater detail in additional modules. Many faculty from different departments and backgrounds provide the instruction. Dr. Province and Staff

Genetic Epidemiology: A Research Elective

After being introduced to current approaches in Genetic Epidemiology, interested students are supervised on research projects dealing with methodological developments as well as analysis of real data. Topics to be covered include: resolution of cultural and biological inheritance, with emphasis on multivariate associations and temporal trends; detection of major gene effects, with emphasis on pleiotropy and genetic heterogeneity; and linkage analysis and gene mapping. Pre- and post-doctoral students in genetic epidemiology are required to take this course. Dr. Rao and Staff

RESEARCH

Research activities of the Division span a wide range of topics dealing with a number of disorders of considerable public health importance, providing research opportunities at both theoretical and applied levels. Several research projects involve close interaction and collaboration with a number of research groups at the Medical Center. The present core research program of the Division deals with genetic epidemiology, especially as it relates to cardiovascular disease. A number of theoretical and applied problems are addressed, including: nurture resolution and identification of the genetic basis of risk factors such as lipids, lipoproteins, apolipoproteins, obesity, blood pressure, sex hormones, and glucose tolerance; exploration of temporal trends in the degree of genetic and environmental effects; and multivariate associations among multiple risk factors. Timely theoretical issues are also addressed, such as the sampling of families through patients, and statistical properties of methods of data analysis. Present collaborative research projects include: a coordinating center for drug trials in neuromuscular diseases, especially Duchenne Dystrophy; studies in psychiatric epidemiology; studies of the epidemiology of falls, hip fracture, and osteoporosis; Centers for the study of diabetes and Alzheimer’s disease; AIDS; a SCOR project involving several laboratory and clinical research protocols on ischemic heart disease; three epidemiological research projects developing methods for increasing public awareness and utilization of measures which are known to decrease the likelihood of developing heart disease, and for encouraging behaviors which will improve prognosis following a heart attack; and epidemiological genetics and family studies of mental disorders, including schizophrenia and alcoholism.

BIOSTATISTICAL CONSULTATION

The Division provides consultation in a wide range of areas including the statistical design of experiments and clinical trials, protocol development, database management, analysis of data, and interpretation of results. Some of the areas of special strength
and expertise include cardiovascular biostatistics, computing, and statistical packages. The Division is well equipped to provide assistance at the stage of preparing grant applications, including careful discussions of study design, sample size calculations, randomization schemes, computer resources, and data analysis.

**Faculty**

**Professor and Director**

Dabeeru C. Rao, Ph.D., Indian Statistical Institute, 1971. (See Departments of Psychiatry and Genetics.)

**Professor Emeritus**


**Professors**


John P. Rice, Ph.D., Washington University, 1975. (See Department of Psychiatry.)

Stanley Sawyer, Ph.D., California Institute of Technology, 1964. (Also Faculty of Arts and Sciences)

Edward L. Spitznagel, Jr., Ph.D., The University of Chicago, 1965. (Also Faculty of Arts and Sciences)

**Associate Professor**

Kenneth B. Schechtman, Ph.D., Washington University, 1978. (See Department of Medicine.)

**Assistant Professor Emeritus**

Barbara B. Hixon, B.S., University of Illinois, 1941.

**Assistant Professors**

Mac Gordon, Ph.D., University of Wisconsin, 1978. (See Department of Ophthalmology and Visual Sciences.)

Zhaohai Li, Ph.D., Columbia University, 1989.

Curtis A. Parvin, Ph.D., University of Minnesota, 1980. (See Departments of Pathology and Medicine.)


George P. Vogler, Ph.D., University of Colorado, 1985.

**Research Assistant Professors**

Ingrid B. Borecki, Ph.D., University of Hawaii, 1981.


**Research Instructors**

Cynthia Arfken, Ph.D., Yale University, 1985.

Laura E. Mitchell, Ph.D., Yale University, 1991.


**INSTITUTE FOR BIOMEDICAL COMPUTING**

The Institute for Biomedical Computing is an inter-school organization which spans computing research activities at both the School of Medicine and the School of Engineering and Applied Science. The Institute was formed from two research laboratory components, the Biomedical Computer Laboratory (BCL) and the Computer Systems Laboratory (CSL), which have sustained close ties with the departments of Computer Science and Electrical Engineering, as well as most departments in the School of Medicine. The Institute now includes the BCL, the Medical Informatics Group, and the Center for Molecular Design.

The BCL emphasizes the development of computer hardware and software systems for use in the solution of research problems in biomedicine. Several systems have seen a progression from exploratory pilot studies, through major development projects, to public availability through commercial distribution. In general, BCL focuses on biomedical research applications which require solutions employing approaches to digital computing not available from commercial vendors or through other computing facilities at Washington University. Such applications often require the integration of computer systems with digital-communication networks for data and information sharing with local and national collaborators as well as to provide access to specialized computational and image display resources. The BCL sustains an active role in the development, support and extension of these networks, as well as computational and display technologies, especially on the medical campus.

The Medical Informatics Group has been formed to promote the application of information science to research and clinical activities; and to provide pre- and post-doctoral training spanning computer science and various disciplines of biomedicine. The Medical Informatics Group is closely linked with the Medical Informatics Division of the Department of Internal Medicine.

The Center for Molecular Design (CMD) provides a core facility with research in the development and application of modern mathematical, computational, and graphics tools to problems in molecular science. It has evolved from a long-term collaboration between CSL, Computer Science, and Pharmacology in the area of drug design, and seeks to provide a base for broad industrial collaboration and strong interactions with other departments at Washington University.

The overall purpose of the Institute for Biomedical Computing is to foster the development and
application of advanced computing and engineering technologies to problems in biomedical science. In addition to its activities in collaborative research, the Institute serves as a focal point for interdisciplinary teaching and student research in areas not yet included in conventional curricula.

Research Opportunities

Research activities of the Institute for Biomedical Computing span a wide range from basic biological science and clinical research to topics in biomedical engineering, signal processing, computer architectures, and integrated circuit design. Many research projects of the Institute involve collaboration with researchers in the basic science and clinical departments of the School of Medicine, or in the Departments of Computer Science and Electrical Engineering of the School of Engineering and Applied Science. Additional collaborations take place through the interdepartmental program in Biomedical Engineering.

Current emphasis in the core research program of the Biomedical Computer Laboratory is on quantitative biomedical imaging, which includes: modeling of biological phenomena as image sources; transduction processes; instrumentation characteristics; data analysis strategies for extraction of information from images; algorithms for image reconstruction and analysis; and development of a distributed facility for image presentation, analysis, and quantification; and high-performance computing using multiple-instruction stream multiple-data stream (MIMD) and single-instruction stream multiple-data stream (SIMD) parallel processors.

Faculty

Professor and Acting Director, and Director of BCL
Lewis J. Thomas, Jr., M.D., Washington University, 1975. (See Departments of Anesthesiology and Cell Biology and Physiology.) (Also School of Engineering and Applied Science)

Professor and Director of Center for Molecular Design
Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Molecular Biology and Pharmacology.)

Associate Professor and Director of the Medical Informatics Group
Mark E. Frisse, M.D., Washington University, 1978. (See Department of Medicine.)

Associate Professor and Associate Director, and Associate Director of BCL
Frederick U. Rosenberger, D.Sc., New York University 1969. (Also School of Engineering and Applied Science)

Assistant Director of BCL
Russell E. Hermes, M.S., Washington University, 1982. (Also School of Engineering and Applied Science)

Major collaborative projects in BCL include research in: 1) the improvement of positron-emission tomography systems, including those employing photon time-of-flight information; 2) the development of image-analysis methods for physical and RFLP mapping of DNA; 3) the development of algorithms for computational light-microscopic optical sectioning; 4) the application of advanced image analysis methods to electron-microscopic autoradiography; 5) the non-invasive delineation of pharmacology, blood flow, and metabolism in the brain; 6) the pathogenesis, treatment and sequelae of ischemic heart disease; 7) digital-communication networks; and 8) radiation-treatment planning.

Drs. Thomas and Rosenberger

The Medical Informatics Group offers special opportunities to participate in and to develop new areas of interdisciplinary informatics research. Research areas of current interest include information retrieval, database theory, clinical decision-making, expert systems, reasoning using temporal data, statistical analysis, electronic publishing, and mathematical modeling. Application areas include molecular genetics, clinical endocrinology, cardiovascular pharmacology, and general internal medicine.

Drs. Frisse and Kahn

Research opportunities in CMD center on algorithm development in molecular modeling, data analysis and presentation in molecular comparisons, interpretation of NMR information, three-dimensional quantitative structure-activity relationships, predictions of secondary protein structure and the protein folding problem.

Drs. Marshall and Beusen

Professor Emeritus

Harold W. Shipton, C.Eng., Shrewsbury Technical College, 1949. (Also School of Engineering and Applied Science)

Professors

R. Martin Arthur, Ph.D., University of Pennsylvania, 1968. (Also School of Engineering and Applied Science)

Jerome R. Cox, Jr., Sc.D., Massachusetts Institute of Technology, 1954. (See Department of Cell Biology and Physiology.) (Also School of Engineering and Applied Science)

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (See Department of Cell Biology and Physiology.) (Also School of Engineering and Applied Science)
Teaching and Research Divisions

Seymour V. Pollack, M.S., Brooklyn Polytechnic Institute, 1960. (Also School of Engineering and Applied Sciences)

Donald L. Snyder, Ph.D., Massachusetts Institute of Technology, 1966. (Also School of Engineering and Applied Science)

Research Professor
Kenneth B. Larson, Ph.D., Massachusetts Institute of Technology, 1964. (See Department of Neurology and Neurological Surgery.)

Associate Professors
G. James Blaine III, D.Sc., Washington University, 1974 (See Department of Radiology.) (Also School of Engineering and Applied Science)

Michael I. Miller, Ph.D., The Johns Hopkins University, 1983. (Also School of Engineering and Applied Science)

John Wai-chiu Wong, Ph.D., University of Toronto, 1982. (See Department of Radiology)

Research Associate Professor
Lyndon S. Hibbard, Ph.D., Michigan State University, 1977. (See Department of Neurology and Neurological Surgery.)

Assistant Professors

Michael G. Kahn, M.D., University of California, San Diego, 1979; Ph.D., University of California, 1988. (See Department of Medicine.)

James G. McNally, Ph.D., The University of Chicago, 1983. (See Department of Cell Biology and Physiology.) (Also Faculty of Arts and Sciences)


Research Assistant Professor
Denise D. Beusen, Ph.D., Washington University, 1985. (See Department of Molecular Biology and Pharmacology.)

Senior Research Associates
William M. Hart, Jr., M.D., Ph.D., University of Maryland, 1970. (See Department of Ophthalmology and Visual Sciences.)

James G. Miller, Ph.D., Washington University, 1969. (See Department of Medicine.) (Also Faculty of Arts and Sciences)

Research Associates
Kenneth H. Clark, M.S., St. Louis University, 1967.

Scott A. DePriest, Ph.D., University of Missouri-Rolla, 1989.

Rexford L. Hill, M.S., University of Cincinnati, 1966. (See Department of Radiology.)


John W. Matthews, D.Sc., Washington University, 1980. (See Department of Radiology.)

Joanne Markham, M.S., Washington University, 1973. (See Department of Medicine.)

David G. Politte, M.S., Washington University, 1983.

Research Assistants
H. Dieter Ambos, C.E.E., Washington University, 1973. (See Department of Medicine.)


David R. Maffitt, M.S., Washington University, 1989.

Chrysanthe Preza, M.S., Washington University, 1990.
HEALTH KEY MEDICAL GROUP

Health Key Medical Group is a primary care group practice providing comprehensive health services to more than 70,000 people in the St. Louis area. Previously established in 1969 as The Medical Care Group of St. Louis, Health Key's relationship with the School of Medicine has been as a teaching and research unit serving within a medical school environment. Today, the group provides care in pediatrics, internal medicine, allergy, and obstetrics/gynecology in a separate facility on the campus of the School of Medicine, as well as in five other locations throughout the metropolitan area, including Illinois.

Staff

Susan R. Adams, M.D., University of Virginia, 1992. (See Department of Medicine.)

William Stuart Adams, M.D., University of Virginia, 1992. (See Department of Pediatrics.)

Patricia J. Amato, M.D., Medical College of Ohio, 1982. (See Department of Pediatrics.)

Scott J. Anderson, Ph.D., Duke University, 1981; M.D., 1982. (See Department of Medicine.)

John K. Appelbaum, M.D., Washington University, 1984. (See Department of Obstetrics and Gynecology.)

Bonnie J. Aust, M.D., University of Texas, 1979. (See Department of Pediatrics.)

Howard J. Aylward, Jr., M.D., Vanderbilt University, 1970. (See Department of Medicine.)

Miriam J. Behar, M.D., The Johns Hopkins School of Medicine, 1981. (See Department of Pediatrics.)

Joyce E. Boehmer, M.D., University of Missouri, 1979. (See Department of Medicine.)

Eyla G. Boies, M.D., Washington University, 1978. (See Department of Pediatrics.)

David C. Brunts, Ph.D., West Virginia University, 1982.

Kathleen S. Brunts, M.D., St. Louis University, 1981. (See Department of Medicine.)

Tattamangalam P. Chandrika, M.D., Calicut Medical College, Calicut, India, 1973. (See Department of Pediatrics.)

James M. Corry, M.D., Washington University, 1974. (See Department of Pediatrics.)

John C. Davis, M.D., University of Michigan, 1980. (See Department of Pediatrics.)

Thomas D. Doerr, M.D., The University of Chicago, 1983. (See Department of Medicine.)

Irl J. Don, M.D., Washington University, 1972. (See Department of Medicine.)

Charles H. Dougherty, M.D., University of Rochester School of Medicine, 1973. (See Department of Pediatrics.)

Jay Stuart Epstein, M.D., Emory University, 1983. (See Department of Pediatrics.)

Renee D. Ewing, M.D., Southern Illinois University, 1984. (See Department of Obstetrics & Gynecology.)

Michael J. Fedak, M.D., University of Missouri, Columbia, 1982. (See Department of Medicine.)

John P. Galgani, Jr., M.D., St. Louis University, 1982. (See Department of Pediatrics.)

David Hartenbach, M.D., University of Missouri, 1987. (See Department of Pediatrics.)


Steven D. Jacobson, M.D., Mayo Graduate School, 1988. (See Department of Medicine.)

William L. Johnson, M.D., University of Missouri, 1981. (See Department of Pediatrics.)


Richard L. Lazaroff, M.D., St. Louis University, 1978. (See Department of Pediatrics.)

Thomas C. McKinney, M.D., Washington University, 1980. (See Department of Pediatrics.)
Gerald Mahon, M.D., University of Texas, 1983. (See Department of Medicine.)
Susan M. Manns-Rizzo, M.D., St. Louis University, 1984. (See Department of Medicine.)
Jerald Maslanko, M.D., Emory University, 1975. (See Department of Medicine.)
Susan J. Nelson, M.D., Washington University, 1978. (See Department of Pediatrics.)
Catherine R. Remus, M.D., Rush Medical College, 1983. (See Department of Pediatrics.)
John H. Rice, M.D., University of Missouri, 1980. (See Department of Medicine.)
Carol A. Robinson, M.D., University of Missouri, 1985. (See Department of Pediatrics and Department of Medicine.)
Isabel L. Rosenbloom, M.D., University of Maryland, 1984. (See Department of Pediatrics.)
Margaret A. Schmandt, M.D., St. Louis University, 1987. (See Department of Pediatrics.)
Paul S. Simons, M.D., Washington University, 1967. (See Department of Pediatrics.)
M. Anne Street, M.D., University of Illinois, 1976. (See Department of Pediatrics.)
Elizabeth A. Tracy, M.D., Medical College of Wisconsin, 1986. (See Department of Medicine)
Stanley G. Vriezelaar, M.D., University of Iowa, 1981. (See Department of Medicine.)
Nancy J. Williams, M.D., University of Kansas, 1987. (See Department of Medicine.)
Patricia B. Wolff, M.D., University of Minnesota, 1972. (See Department of Pediatrics.)
GRADUATE PROGRAMS

DIVISION OF BIOLOGY AND BIOMEDICAL SCIENCES

The Division of Biology and Biomedical Sciences, organized in 1973, is a consortium of eight university departments which together provide interdisciplinary training for Ph.D. students. This unique organization was formed because of the realization that research and training in modern biology transcend the limits of departmental structure. The faculty consists of members of seven preclinical departments in the School of Medicine-Anatomy and Neurobiology, Biochemistry and Molecular Biophysics, Cell Biology and Physiology, Genetics, Molecular Microbiology, Pathology, and Molecular Biology and Pharmacology-and of the Department of Biology in the School of Arts and Sciences. These 280 faculty are affiliated with one or more of six broad training programs: Developmental Biology; Evolutionary and Population Biology; Immunology; Molecular Biophysics; Molecular Cell Biology and Biochemistry; Molecular Genetics; Molecular Microbiology and Microbial Pathogenesis; Neurosciences; and Plant Biology. Faculty in these programs take responsibility for all Divisional activities, including recruiting, admissions, advising, research training, and in addition many Divisional courses and seminars are offered by the participating faculty.

Currently over 360 graduate students are enrolled in the Division, including 120 students pursuing both the Ph.D. and the M.D. through the Medical Scientist Training Program (see page 18). Requirements for the Ph.D. in each Divisional Program are highly flexible. They include a series of courses tailored to a student’s background and interests, qualifying examinations usually taken during the second year, execution of laboratory research, and defense of a dissertation generated through original scientific investigation. Although students enter the Division through an affiliation with one of the nine programs, it is possible for a student to transfer to another program as interests evolve. During the first year, advisers are appointed to assist students in selecting courses and seminars as well as to help them in choosing three laboratory rotations in which they will spend several months becoming acquainted with a particular area of scientific research. At the end of the first year, it is expected that each student will choose a research adviser, whereupon the student will be affiliated with one of the departments of the Division. Continued participation in both Divisional and departmental activities assures the versatility of interests developed during the first year.

Applications for admission to the Ph.D. programs of the Division are due January 1 for matriculation the following Fall. Admission is based on demonstrated ability, future promise, and the number of positions currently available. Applicants should have completed undergraduate training in biology, chemistry, or physics at a high level of scholastic achievement; such training should include courses in biology, genetics, chemistry (including analytical, organic, and physical), physics, and calculus. In exceptional cases, deficiencies in basic requirements may be made up by appropriate course selection during the first year of study. It is required that each applicant take the aptitude test of the Graduate Record Examination (GRE). The advanced GRE subject test is highly recommended. Additional information and application for admission to the Ph.D. programs may be obtained by writing to the Graduate Studies Office, Washington University School of Medicine, 660 South Euclid Ave., Campus Box 8226, St. Louis, Missouri 63110-9822. Students who wish to pursue both the Ph.D. and M.D. degrees must apply to the Medical Scientist Training Program (see page 18).

Students admitted to the graduate programs are guaranteed full stipend, a one-time relocation allowance, and tuition support contingent upon satisfactory performance. The stipend for the 1992-93 academic year will be $13,600 annually. The tuition and health fee for a full-time student will be $17,613 per year. This provides coverage by the Medical Center Student Health Service. The Division provides support for its Ph.D. students from several sources, including federally funded training grants provided by the National Institutes of Health. Support through such grants is subject to payback agreement and taxability provisions appropriate to the award.

It is expected that each student in a Ph.D. training program will devote full time to that endeavor. The Division will not accept students for part-time study, nor will it enroll students interested in a Master's degree.

The following graduate courses are offered by the Division of Biology and Biomedical Sciences, and they are available both to Ph.D. and M.D. students who meet the prerequisites for the appropriate course. Those courses particularly relevant for a given department are cross-listed under the department in this Bulletin. Faculty members in charge of courses and their departmental affiliations are shown at the end of each course description.
Bio 401. Vertebrate Physiology
This three credit-hour lecture series covers comparatively the integrated functional operation of the organ systems of vertebrates, exclusive of the endocrine system. Credit 3 units. Coles (Biology)

Bio 4011. Comparative Vertebrate Physiology
Lecture series covers comparatively the integrated functional operation of the organ systems of vertebrates, exclusive of the endocrine system. Credit 3 units. Coles (Biology)

Bio 402. Molecular and Cellular Basis of Plant Development
A lecture course emphasizing the molecular and cellular aspects of plant development. The first two thirds of this course deal with unique processes in the life cycle of plants such as seed development, flowering, photosynthesis and symbiosis with nitrogen fixing bacteria. The last one third deals with special topics such as herbicide action, response to environmental stress and genetics engineering. Credit 3 units. Ho (Biology)

Bio 404. Laboratory of Neurophysiology
Neural analysis of sensory information, and organization of neural activity will be electrophysiologically studied by students to find out how some of the interesting experiments in neurophysiology are actually performed. Resting and action potentials, excitation transmission, sound- and photo-reception, analysis of human and animal sounds, and psychological phenomena will be examined. Credit 3 units. Suga (Biology)

Bio 4041. Historical Roots of Neuropsychology and the Brain Sciences
The relationship between brain and behavior will be examined beginning with trepanation and head injuries in ancient man, through ancient Egypt, Greece, and Rome, and into the Renaissance and more modern times. Emphasis will be placed on higher brain functions. Credit 3 units. Finger (Psychology)

Bio 408. Human Evolution
The fossil evidence for human and nonhuman primate evolution. Classification and genetics in evolutionary perspectives, relations between biology and culture in ancient and modern populations. Credit 3 units. Norconk (Biology)

Bio 411. Phycology
A systematic treatment of the freshwater and marine algae. Emphasis primarily on morphology, physiology, taxonomy, and genetics of the major and minor algal groups. Certain aspects of recent research and present problems in phycology will be considered. Credit 4 units. Nichols (Biology)

Bio 412. Experimental Aquatic Biology
Studies of current research problems and research techniques devoted to aquatic flora and fauna. The course will include group or individual participation in a research problem or problems dealing with individual aquatic components of the aquatic environment or their interaction. Credit 4 units. Nichols (Biology)

Bio 4132. Plant Diversity
Concepts of classification and speciation emphasizing the diversity of flowering plants. Laboratory focuses on evolutionary mechanisms utilizing accepted systems of angiosperm phylogeny. A seven-week course, first in a series of four. Credit 2 units. Lewis (Biology), Staff

Bio 4133. Plant Molecular Biology
Discussion of molecular aspects of plant development, genetics of the organelles, host/symbiont interactions, plant genetic engineering. A seven-week course, second in a series of four, beginning in the eighth week of the semester. Credit 2 units. Beachy (Biology)

Bio 4134. Physiology and Biochemistry of Plants
A discussion of those processes unique to plant development: seed development and germination, action and metabolism of hormones, photomorphogenesis, responses to environmental stresses. A seven-week course, third in a series of four. Credit 2 units. Ho, Varner (Biology)

Bio 415. Bioenergetics
A discussion of bioenergetic processes with emphasis on photosynthesis, nitrogen fixation, and related processes. A seven-week course, last in a series of four. Credit 2 units. Pakrasi (Biology)

Bio 4136. Biochemistry and Physiology of Plants
A discussion of those processes unique to plants including seed development and germination, action and metabolism of plant hormones, photomorphogenesis, photosynthesis, plant nitrogen metabolism, and plant response to environmental stresses. Credit 3 units. Ho, Kohl, Pakrasi, Pickard, Varner (Biology)

Bio 4181. Population Genetics
An introduction to the basic principles of population and ecological genetics. The mechanisms of microevolutionary processes are discussed, and an integrated ecological and genetic approach is used to study the adaptive nature of the evolutionary process. Credit 3 units. Templeton (Biology)
Graduate Programs

Bio 4182. Macroevolution
An advanced introduction to the study of macroevolutionary patterns and processes with emphasis on the systematic methodology employed. Topics: theories of classification, phylogenetic reconstruction, testing of historical hypothesis, hierarchy theory, adaptation, extinction, speciation, developmental mechanisms of organismal evolution, biogeography. Credit 3 units. Larson (Biology)

Bio 419. Ecology
A survey of ecological principles underlying the spatial and temporal distribution of populations and biological communities. Credit 3 units. Sexton (Biology)

Bio 4201. Natural History of Vertebrates
Lectures, discussions, and laboratory/field work devoted to the identification and life histories of local terrestrial vertebrates. Mammals and birds considered, but emphasis upon amphibians and reptiles; role of field observations in eliciting testable hypotheses stressed. Enrollment limited to sixteen. Two lectures and one field trip per week. Prerequisite, Bio 301. Credit 3 units. Sexton (Biology)

Bio 424. Immunology
The basic molecular and cellular aspects of the vertebrate immune response, emphasizing the specificity of immune reactions, the structural and genetic basis of antibody diversity, and the cellular mechanisms involved in antigen recognition and the formation of specific immune responses. Other topics: regulation of immunity, allergy, tissue transplantation, and mechanisms of complement activation. Credit 3 units. Fleischman (Molecular Microbiology)

Bio 430. Advanced Microbiology Laboratory
A laboratory course that covers standard bacteriological techniques in addition to current genetic and molecular approaches for the study of microorganisms. Procedures and concepts include: microscopy, culturing, bacteriological typing, growth, nutrition, physiology, transposon mutagenesis, gene fusions, gene regulation, transduction, use of genomic libraries. Credit 4 units. Nichols, Curtiss, Kranz (Biology)

Bio 437. Laboratory on DNA Manipulation
An introduction to laboratory techniques for experimental manipulation of DNA molecules, including construction, isolation, and analysis of plasmids and bacteriophage and DNA sequencing. A molecular cloning experiment will be performed as a class project. Credit 4 units. Landick, Staff (Biology)

Bio 438. Molecular Approaches to Medicine: Genetic Disease
A lecture/discussion course on work at the interface of molecular biology and medicine. Consideration of techniques used to identify and characterize genes in human inherited disease; presentation of a cross-section of diseases under study at Washington University by medical school staff. Written and oral presentation of a major research paper required. Credit 2 units. Elgin (Biology), Dowton (Pediatrics)

Bio 441. Problems in Developmental Biology
Some basic problems related to organismic development (such as the regulation of gene expression, cell-cell interaction, pattern formation) will be examined. Students will be introduced to each subject through lectures on both classical and modern experimental work. In-depth discussion on current approaches will be emphasized. Credit 3 units. Kirk, Staff (Biology)

Bio 4411. Molecular Approaches to Development
Current experimental approaches to problems in early embryonic development; emphasis on molecular genetic and cell biological studies of a variety of model systems. Lectures and in-depth discussion of current literature. Miller, McNally (Biology)

Bio 445. Microbial Genetics
A course providing lectures and laboratory experience on: mutation, mutagenesis, and mutant isolation; bacteriophage genetics; gene transfer by transformation, transduction, and conjugation; and complementation analysis and gene regulation. Credit 4 units. Curtiss (Biology)
Bio 446. Biology of the Fungi
General aspects of the biology of the fungi, including their development, genetics, cell biology, metabolism, evolution, and ecology. Roles these microorganisms play in nature, research, medicine, industry, and agriculture. Selected living representative species studied in laboratory, with appropriate exercises on pure culture and isolation techniques and studies of morphology, growth, physiology, fermentation, cytology, life cycles, genetics, taxonomy, and identification procedures. Credit 3 units. Maniotis (Biology)

Bio 450. Topics in the History of Eugenics
A research seminar in which students will carry out in-depth research projects on eugenics movements in the United States or Europe (1890-1960). Topics can include: genetic basis of eugenic theories, funding of the Eugenics Movement, connections between U.S. and other (e.g., Nazi) eugenics movements, etc. Credit 3 units. Allen (Biology)

Bio 451. General Biochemistry
A study of structure-function relationships as applied to carbohydrates, proteins, and lipids; intermediary metabolism of principal cellular components and general aspects of regulation. Credit 4 units. Chilton (Biology)

Bio 452. Biochemistry Laboratory
An experimental approach to selected biochemical problems, with primary focus on the isolation and characterization of proteins. Examples of both enzymatic and non-enzymatic proteins are studied. Credit 3 units. Chilton (Biology)

Bio 454. History of Genetics
A seminar dealing with selected topics in the history of genetics, focusing largely on the period since 1900. The first part of the seminar (weeks 1-7) will be devoted to exploration of specific topics (with primary and secondary source readings) such as: the background development of Mendel's work, cytology (1860-1930); the biometrical movement, heredity, and evolution (1860-1900); the rediscovery of Mendel, the chromosome theory and the Morgan school; Mendelism and Darwinism (1900-1940); biochemical genetics, molecular genetics, and the Eugenics Movement (1890-1940). The second part of the course will be devoted to presentation and discussion of student research papers. Credit 3 units. Allen (Biology)

Bio 487-488. Undergraduate Teaching
Exceptional undergraduates may serve as teaching assistants for laboratory and/or discussion sections in departmental courses. Normally, 2 or 3 credits are given per semester for teaching activity, subject to the approval of the course instructor and the Department. Credit for teaching may not be counted toward fulfilling biology degree requirements. Students who are asked to teach, or those who apply and are accepted by a course instructor, should fill out an application form to be obtained from the Biology Department office. Credit 2 or 3 units. Must be taken Credit/No Credit only. Staff (Biology)

Bio 493. Seminar in Advanced Biology
This seminar will deal with topics which tend to cut across disciplinary lines within Biology. Topics, staff, and prerequisites will vary from semester to semester and will be announced during the prior preregistration period. Credit to be arranged. Staff (Biology)

Bio 500. Independent Work
Prerequisite: junior or senior standing and permission of the sponsor and the Department. Credit to be determined in each case. Maximum of 6 units may be applied toward upper division credits required for the major. If the work is to be submitted for honors, further requirements are a B+ average in biology courses, a B+ average in related subjects required for a biology major, a B+ average overall, and registration for 3 units in each of 2 semesters; an honors thesis must be prepared. Credit/No Credit only. Kohl (Biology)

Bio 501. Human Anatomy
Study of the gross structure of the human body primarily by dissection. Consent of the instructor required. Credit 6 units. Conroy (Anatomy/Neurobiology), Phillips-Conroy, Cheverud

Bio 5011. Ethics and Research Science
Exploration of ethical issues research scientists confront on a daily basis. Topics will include, but are not limited to: Student-mentor relationships, allegations of fraud, collaborators rights and responsibilities, conflicts of interest and confidentiality, ethics and the Genome Initiative, oversight role of institutions. Case study and scenario presentations will provide focus for discussions. Credit 1 unit. Donis-Keller (Genetics/Psychiatry)

Bio 502. General Physiology
This course applies the fundamental physiological mechanisms of cell biology to the functions of the major organ systems of the body, namely, the cardiovascular, renal, respiratory, gastrointestinal, and endocrine systems. The course is intended primarily for first-year medical students. Credit 6 units. Wilkinson, Staff (Cell Biology/Physiology)
Bio 5051. Foundations in Immunology
An in-depth introduction to immunology designed for graduate students. Topics: antibody structure and genetics, B cell recognition, T cell receptor, major histocompatibility complex, T cell recognition, regulation of the immune response, immune mediators, humoral and cellular effector mechanisms, immune control of infectious disease, immunopathology including hypersensitivity and deficiency. Credit 3 units. Cullen (Molecular Microbiology)

Bio 5061. Cell Biology
An introduction to cell biology and cell physiology. The approach is best described as biophysical and biochemical cytology. Topics: fundamentals of membrane transport, endocytosis, exocytosis and bulk membrane flow, biogenesis and function of cellular organelles, the cytoskeleton, the biology of mitosis, the extracellular matrix, and cell-cell interactions. Four lectures each week during the first medical school trimester, supplemented with demonstrations and small group conferences. Focuses on problem sets and discussion of recent and/or classical publications. (Optional—during the last 6 weeks of the course, regular meetings will be reduced to 1 hour per week for discussion of literature and preparation of a short research proposal. Any faculty member of the Cell Biology Program can serve as an advisor for the research proposal.) Credit 4 or 5 units (5 if optional tutorial is taken.) Stahl (Cell Biology/Physiology)

Bio 5062. Central Questions in Cell Biology
Fundamental questions in the following areas of cell research: cell-cell interactions; biogenesis of organelles; cytoskeleton; cell physiology; cell differentiation. For each section, introductory lectures and laboratory demonstrations are accompanied by discussions of experimental techniques and evaluations of the strategies employed in recent papers. Credit 3 units. Staff (Cell Biology/Physiology)

Bio 5063. Molecular Cell Biology
An introduction to molecular cell biology through exploring the biophysical, biochemical, and molecular basis of cell function. Topics: fundamentals of membrane transport and receptor signaling; endocytosis, exocytosis and bulk membrane flow; biogenesis and function of cellular organelles; the cytoskeleton; the extracellular matrix; cell-cell interactions; and the generation of cell polarity. The format will be 3 hours of lecture and 1.5 hours of discussions which focus on problem sets and discussion of recent and/or classical publications. Credit 4 units. Stahl (Cell Biology/Physiology), Staff
Bio 5064. Introduction to Modern Techniques of Electron Microscopy

A practical course for those students who anticipate using electron microscopy (EM) in their research. Lectures and demonstrations will compare and contrast the various methods of sample preparation and specimen viewing currently in use, emphasizing the pros and cons of each. Students learn to evaluate works in the EM literature critically and to design meaningful EM experiments. Lab exposure will include overseeing freeze-etch techniques and individual time working with an electron microscope. Credit 3 units. Heatser (Cell Biology/Physiology), Goodenough (Biology)

Bio 507, 508. Pharmacology

Biological basis of drug action. The course is divided into three parts: general pharmacology, cardiovascular, and neuropharmacology. Bio 508 must be taken in the spring semester to complete the course. Credit 4 units. Covey (Pharmacology), Staff

Bio 5083. Principles of Protein Chemistry

Designed to provide a background in the fundamentals of protein chemistry; stresses both the theoretical and practical aspects of the subject matter. Topics include: peptide synthesis, protein purification and sequencing, enzyme kinetics, protein structure/function and an introduction to x-ray crystallography, NMR, and electron microscopy. Credit 3 units. Pike (Biochemistry/Molecular Biophysics)

Bio 509, 510. Current Topics in Pharmacology

Topics of current interest presented and discussed. Critical evaluation will be made of recent articles in the scientific literature. Required of all graduate students in the department. Credit 1 unit. Russell (Pharmacology)

Bio 511. Intracellular Transport of Macromolecules in Animal Cells

A discussion of the organelles responsible for the movement of macromolecules in cells. Endoplasmic reticulum, the Golgi apparatus, secretory vesicles, plasma membrane, lysosomes. Emphasis will be placed on specific recognition as a means for translocation of macromolecules and organelles. Part of the course will use the seminar format. Credit 2 units. Stahl, Mercer, Mueckler (Cell Biology/Physiology)

Bio 512. Selected Topics in Developmental Biology

A lecture-seminar course devoted to an in-depth analysis of a restricted number of topics of major current interest in developmental biology. A series of guest lecturers whose research is at the forefront of the area of interest will be invited to the campus to discuss their research activities with the class. These guest lectures will be supplemented by extensive readings from the current literature, lectures by local faculty, and informal discussions. Students will be evaluated on the basis of a research proposal they will prepare during the semester. Credit 2 units. Goodenough, Kirk (Biology)

Bio 5121. Topics in Organ Systems

Designed to familiarize graduate students with the workings of whole organs. The student chooses one of the three organ systems (heart and vasculature, kidney, lungs and respiration) and is assigned a faculty committee, tutorial, and laboratory. Credit 1-6 units. McCleskey (Cell Biology/Physiology)

Bio 5122. Cell-Matrix Interactions

Structure of extracellular matrix receptors and their ligands and cell adhesive receptors (integrins, CAMS, etc.) Specific examples from inflammation and immunology, cancer cell biology, development biology, and hemostasis. Credit 3 units. McDonald (Medicine), Brown, Dean, Frazier, Mecham, Parks, Santoro, Roman

Bio 5124. Cell Biology Journal Club

Discussion of key papers on all aspects of cell biology. Emphasis on recent papers that have addressed fundamental questions relevant to cell biology. Credit 1 unit. Parkinson (Cell Biology/Physiology)

Bio 5125. Student-Run Cell Biology Journal Club

Student participants present summaries of current research published in various journals in the field of cell biology. Substantial emphasis on coaching for oral presentation. Credit 1 unit. Stahl (Cell Biology/Physiology)

Bio 5126. Developmental Biology Journal Club

Students, post-doctoral fellows, and faculty present summaries of current research published in various journals in the field of developmental biology. Credit 1 unit. Miller (Biology)

Bio 5127. Pathobiology Journal Club

Student participants present summaries of current research published in various journals in the general fields of cell and developmental biology. Substantial emphasis on coaching for oral presentation. Credit 1 unit. Baenziger (Pathology)
Bio 5128. Extracellular Matrix and Cell Matrix Interactions Journal Club
This journal club covers presentations by students, post-doctoral fellows and faculty for a broad range of topics of current interest, including the fields of biochemistry, molecular biology, cell biology, and developmental biology. Speakers give a brief background and focus on one-to-two papers from the current literature. Credit 1 unit. Mecham (Cell Biology/Physiology)

Bio 5132. Cell Motility and Cytoskeleton Journal Club
Weekly presentations of recent literature and research, with each participant presenting once per semester. Opportunity for students to discuss the context, implications and future directions for research. Credit one unit. Cooper (Cell Biology/Physiology), Staff (Biochemistry/Molecular Biophysics)

Bio 5134. Topics in Cell Motility and Cytoskeletal Function
Selected questions concerning cell motility and the structure and function of the cytoskeleton will be explored in depth. The course presents a thorough and critical reading of the research literature presented for class discussions. Credit 2 units. Elson (Biochemistry/Molecular Biophysics), Cooper (Cell Biology/Physiology)

Bio 5141. Advanced Cell Biology
A course designed for advanced students in the area of cell biology and related fields. Lectures and readings stress recent advances in selected areas of eukaryotic cell biology. This year the focus is on changes in cell behavior mediated by cell-cell and cell-extracellular matrix interactions. Credit 3 units. Goodenough (Biology)

Bio 515, 516. General Pathology
General introduction to abnormal biology and detailed consideration of pathology of organ systems. Continuous through two semesters. Not available for credit to those holding M.D. degrees. For complete course description, see listing in the Department of Pathology. Credit 10 units for the year. Staff (Pathology)

Bio 5171. Medical Immunology
An introduction to basic concepts in immunology and immunopathology. Lectures will focus on antigen-antibody interactions, immunoglobulin structure and genetics, the cellular basis of the immune response and immune regulation, T cell effector mechanisms, the inflammatory response, complement, the positive and negative roles of hypersensitivity, and immune deficiency. Credit 2 or 3 units. Unanue (Pathology), Braciale, Atkinson, et al.
Bio 5278. Topics in Immunology II
Reading and discussion on topics in molecular immunology including molecular biology of antigen-specific receptors, lymphokines and their receptors, lymphoid cell growth control, and specific aspects of MHC genetics. Course stresses molecular approaches and how these findings relate to other non-immunological gene systems. Credit 2 units. Korsmeyer (Molecular Microbiology)

Bio 5279. Immunopathology
Lectures and student presentations covering a wide range of topics on clinical immunology including inflammation, microbial immunity, immunodeficiencies, immunopharmacology, neuroimmunology, autoimmunity, and lymphoid malignancies. Credit 2 units. Thomas (Pathology)

Bio 5281. Developmental Genetics
Genetics of developmental events, including sex determination, pattern formation, cell fate, and regulation of tissue specific genes. Emphasis will be placed on the use of genetics to investigate these phenomena in organisms such as yeast, C. elegans, Drosophila, and mouse. Credit 3 units. Waterston (Genetics), Staff

Bio 5282. Advanced Biochemistry
Designed primarily for medical students, study of major control systems of metabolic processes. Assuming a familiarity with basic metabolic pathways, focus is on the regulation of enzyme activity, hormone receptors and their signal transduction mechanisms, the role of kinases in metabolic regulation, lipoproteins and the regulation of lipid metabolism, control of cellular proliferation, oncogenes, hemo-stasis and thrombosis, platelet activation and aggregation, mechanisms of cell adhesion, and the role of the extracellular matrix as a regulator of cellular phenotype. Coordinated with the other first semester courses (Cell Biology, Molecular Biology and Genetics) to provide an integrated first semester curriculum in the basic science of medicine. Credit 3 units. Frazier (Biochemistry/Molecular Biophysics)

Bio 531. Advanced Biochemistry
Designed primarily for medical students, study of major control systems of metabolic processes. Assuming a familiarity with basic metabolic pathways, focus is on the regulation of enzyme activity, hormone receptors and their signal transduction mechanisms, the role of kinases in metabolic regulation, lipoproteins and the regulation of lipid metabolism, control of cellular proliferation, oncogenes, hemo-stasis and thrombosis, platelet activation and aggregation, mechanisms of cell adhesion, and the role of the extracellular matrix as a regulator of cellular phenotype. Coordinated with the other first semester courses (Cell Biology, Molecular Biology and Genetics) to provide an integrated first semester curriculum in the basic science of medicine. Credit 3 units. Frazier (Biochemistry/Molecular Biophysics)

Bio 5321. Current Topics in Metabolic Regulation
This course will provide an in-depth study of specific examples of biochemical regulation that are currently unfolding. Common themes in regulation will be stressed in order to demonstrate how the regulation of diverse pathways can be achieved using a limited number of mechanisms. It is designed for students who have had a course in basic biochemistry and wish to achieve an integrated understanding of the system. Lectures will begin with a basic metabolic pathway or phenomenon and will briefly trace the history of research in that area to show the natural progression of science from a delineated pathway to our current understanding of the molecular basis of its regulation. Topics to be covered will include signal transduction, hormone action, regulation of gene expression, LDL and cholesterol metabolism, and will vary periodically to include new areas of research. The course will be a combination of didactic lectures (80 percent) and student discussions of current literature (20 percent). Credit 3 units. Pike (Biochemistry/Molecular Biophysics), Rotwein, Sadler, Silbert

Bio 5332. Biochemistry Journal Club
Student-presenters present summaries of current research published in various journals in the field of biochemistry. Substantial emphasis on coaching for oral presentations. Credit 1 unit. Frazier (Biochemistry/Molecular Biophysics)

Bio 5332. Regulatory Biology
Mechanisms of regulation of biochemical and physiological pathways from the perspectives of the cell tissue and whole organisms. Three areas covered: intermediary metabolism; growth and growth factors; cardiovascular function and homeostasis. Credit 2 units. Rotwein (Medicine)

Bio 5352. Developmental Biology
Current literature and present information available on a variety of model systems being used to study developmental biology. Focus on molecular approaches, but based in classical concepts. Credit 2 units. Rotwein (Medicine)
Bio 5353. RNA Processing, Ribosomes, and Gene Expression

Information in this area of prokaryotic and eukaryotic cells, with emphasis on mechanisms involved. The relationship of RNA processing to gene expression in prokaryotes, animal viruses, and eukaryotic cells; the contribution of this phenomenon to differential gene expression during development and differentiation. Sessions include informal presentation of the background material followed by a group discussion and a student presentation on a particular aspect of the problem. Credit 2 units. Apirion (Molecular Microbiology)

Bio 536. Physical Chemistry of Macromolecules

Application of physical chemistry to the study of proteins, nucleic acids, and other natural and synthetic polymers. The thermodynamics and statistical mechanics of dilute macromolecular solutions, osmotic pressure, light scattering, viscosity, ultra-centrifugation, diffusion, circular dichroism, and analysis of conformational transitions. Credit 3 units. Holtzer (Chemistry)

Bio 537. Protein Chemistry and Enzyme Mechanisms

Protein chemistry; 3-dimensional protein structure and function relationships studied by crystallography and NMR, Site-directed mutagenesis, enzyme kinetics, and mechanisms. Credit 3 units. Birkoft (Biochemistry/Molecular Biophysics), Staff (Biochemistry Library)

Bio 538. Structure & Function of Cell Membranes and Surfaces

Different emphasis in different years, topics include: contemporary cell membrane models; membrane structure as revealed by physical and biological methods; physical properties of lipids and membrane proteins; permeability and active transport in mammalian and bacterial systems; cell recognition, membrane targeting receptors, and transduction systems. Credit 3 units. Frazier, R. Kornfeld (Biochemistry/Molecular Biophysics), Staff

Bio 5381. Mechanisms of Protein Targeting and Intercompartmental Transport

Recent advances regarding the molecular mechanisms responsible for targeting and intercompartmental transport of proteins to and between specific organelles, such as the endoplasmic reticulum, golgi apparatus, lysosomes, mitochondria, and nucleus. Particular emphasis on the development and use of cell-free systems that faithfully reconstitute key protein targeting and transport events. Material consists primarily of original research articles presented by students. Credit 1 unit. Blumer (Cell Biology and Physiology)

Bio 539. Topics in Animal Virology: The Molecular Biology of Animal and Plant Viral Diseases

RNA and DNA virus replication, shut-off of host protein biosynthesis, interferon, retroviruses with emphasis on chronic diseases (i.e., visna, AIDS), defective viruses (i.e., satellite RNA of tobacco ring spot virus, hepatitis delta virus), viruses as vectors and their possible role in preventing disease. Course consists of lectures and discussions of original papers. Credit 3 units. S. Schlesinger, M. Schlesinger (Molecular Microbiology), Beachy, R. Thach (Biology)

Bio 5391. Mechanisms of Protein Targeting and Intercompartmental Transport

General concepts of basic virology and the molecular mechanisms of viral replication; a review of the molecular biology of the major classes of viruses with an in depth analysis of a prototype of each class. Emphasis on animal viruses, and medical virology, but plant and insect viruses also discussed. Credit 3 units. Olivo (Medicine)

Bio 5392. Molecular Microbiology and Pathogenesis

First half on prokaryotic physiology and genetics, with special attention to recent discoveries in gene regulation and protein processing. Second half devoted to microorganisms that cause disease, with emphasis on the molecular interactions between pathogen and host. Credit 3 units. Munson (Pediatrics)

Bio 5404. Molecular Neurobiology

This course will cover the molecular biology and biochemistry of synaptic function, receptor recognition and regulation. Topics will include the structure and function of neurotransmitter receptors, ion channels, and the mechanisms involved in the metabolism, storage, and release of neurotransmitters. Examples will be chosen (from cholinergic, adrenergic and peptidergic systems) to illustrate applications of biochemistry and molecular biology to the analysis of these areas. Lectures, problem sets, reading and presentation of original articles. Credit 4 units. Gottlieb (Anatomy/Neurobiology), Neural Science Staff

Bio 5416. Molecular Microbiology and Pathogenesis Journal Club

Presentation by students, post-doctoral fellows, and faculty on a broad range of topics of current interest, including the fields of molecular mechanisms of pathogenesis, biochemistry, molecular biology, cell biology, developmental biology, and immunology. Speakers usually give a brief background to introduce the topic and then focus on one-two papers from the current literature. Credit 1 unit. Hultgren (Molecular Microbiology)
Bio 5417. Hematology/Oncology Journal Club
Presentations by students, post-doctoral fellows, and faculty on a broad range of topics of current interest, including biochemistry, molecular biology, cell biology, developmental biology, and immunology. Speakers give a brief background and then focus on one-to-two papers from the current literature. Credit 1 unit. Majerus (Medicine)

Bio 5451. Introductory Biophysical Chemistry
Introductory physical chemistry with emphasis on biochemical applications. The course offers an introduction to chemical thermodynamics, spectroscopy, hydrodynamics, kinetics and diffraction methods in the life sciences. Designed for students with no background in physical chemistry. Credit 3 units. Elson (Biochemistry/Molecular Biophysics)

Bio 5461. Molecular Recognition
The physical basis of molecular recognition as exemplified in biological systems examined from several viewpoints: quantum chemistry, molecular mechanics, molecular dynamics and Monte Carlo simulations, and structure-activity relations. Molecular modeling and computer graphics techniques as well as current approaches in quantitative structure-activity relations based on correlation of physical properties of drug molecules, and computer-aided drug design will be reviewed. Credit 3 units. Marshall, Covey (Pharmacology), Dammkoehler (Computer Science)

Bio 5462. Principles of Molecular Recognition II
The physical basis of molecular recognition examined, using quantum chemistry, molecular mechanics, and conformational analysis. Molecular modelling and computer graphics techniques demonstrated and applied. Credit 3 units. Marshall (Pharmacology), Ponder (Molecular Biochemistry/Biophysics), Beunsen (Biomedical Computing)

Bio 548. Nucleic Acids & Protein Biosynthesis
Fundamental aspects of the structure, biosynthesis, and function of nucleic acids and the biosynthesis of proteins. Emphasis will be placed on mechanisms involved in the biosynthetic processes and the regulation thereof. Credit 3 units. Johnston (Genetics)

Bio 5491. Advanced Genetics
Fundamental aspects of organismal genetics with emphasis on experimental studies that have contributed to the molecular analysis of complex biological problems. Examples drawn from bacteria, yeast, nematodes, fruit flies and mammalian systems. Credit 3 units. Johnston, Schedl (Genetics)

Bio 5492. Human Molecular Genetics
In-depth review of recent advances in human genetics. Topics include molecular basis of color vision, muscular dystrophy, tumor formation, hyperlipidemias, chromosomal translocation, sex chromosomes, gene therapy, and RFLP analysis. Credit 2 units. Gerhard (Genetics), Loh (Medicine)
Bio 550. Medical Genetics
Lectures on topics including population and quantitative genetics, clinical cytogenetics, biochemical genetics and metabolic defects. Credit 2 units. Hansen (Genetics)

Bio 5502. Molecular Aspects of Vision
Seminar on useful research strategies used to elucidate the molecular basis of light detection including the biochemical, biophysical and electrophysiological events. Discussions of the molecular basis of inherited ocular cancer, color blindness and retinitis pigmentosa included. Credit 1 unit. Blazynski (Biochemistry & Molecular Biophysics)

Bio 5503. Molecular Pathobiology of Visual Disorders
The fundamental basis, diagnosis, and management of diseases affecting the visual system, with emphasis on genetic and immunologic factors. Each topic addressed in two sessions; the first covers the fundamental etiology, the second is led by a clinician-scientist who has experience in the diagnosis and management of affected patients. Credit 3 units. Petrash (Ophthalmology)

Bio 5502. Memory
A seminar course exploring experimental and theoretical approaches to understanding the biological basis of memory. Participants will read and discuss original literature with the goal of deciding what are (and are not) potentially useful avenues into this poorly understood phenomenon. Credit 3 units. Lichtman (Anatomy/Neurobiology)

Bio 554. Neural Sciences
The course is a consideration of cellular aspects of the nervous system and of the neural systems of the brain and spinal cord. Credit 5 units. Woolsey (Anatomy/Neurobiology), Staff

Bio 5562. Neural Development
An introduction to the development of the nervous system stressing principles. Credit 4 units. Lichtman, Tagert (Anatomy/Neurobiology)

Bio 5571. Cellular Neurobiology
A survey of the basic principles of nerve cell structure and function, including quantitative analysis of voltage and chemically gated ion channels, synaptic transmission and sensory transduction. Lectures and conferences supplemented with readings of classic and contemporary papers. Credit 4 units. Steinbach, Staff (Anatomy/Neurobiology)

Bio 5581. Physiological Basis of Acoustic Communication
Lectures and seminars in hearing and acoustic signals of animals, from invertebrates to humans. Structural and functional adaptation for processing the signals for communication and echolocation are considered. Suga (Biology)

Bio 5591. Topics in Excitable Membranes
A combination of lectures and original reading covering molecular and cellular aspects of excitability for advanced students. McCleskey (Cell Biology and Physiology)
Bio 5601. Topics in Cognitive Neuroscience
How the brain organizes behavior, emphasizing higher functions such as perception, language, and attention. Aim is a useful integration of information from neurobiological approaches (e.g., single unit recording, lesion-behavior experiments), and information-processing approaches (e.g., cognitive psychological models, connectionist models). Credit 3 units. Petersen (Neurology/Neurological Surgery)

Bio 5611. CNS Efferent Control of Sensory Function
The CNS can potentially modulate all incoming sensory information by the efferent control of primary sensory organs. Examples are the efferent vestibular and auditory systems, the efferent visual system of birds (isthmo-optic) and the efferent control of photoreceptors in Limulus. The neurobiology of these and other efferent systems will be studied. This course is intended for advanced graduate students. Credit 2 units. Highstein, Steinacher (Anatomy/Neurobiology)

Bio 5651. Neural Systems
Introduction to the structure and function of the major systems within the central nervous system. Selected topics are chosen to provide an overview of the brain with emphasis on major general concepts. Laboratories and readings of the primary literature are an integral part of this course. Credit 4 units. Price (Anatomy/Neurobiology), Highstein, Burkhalter, Staff

Bio 5661. Topics in Vision Research
Mechanisms of transduction and adaptation in photoreceptors; retinal circuitry and transmitters; development, structure and function of post-retinal visual areas; effects of visual deprivation. Credit 3 units. A. Cohen (Anatomy/Neurobiology)

Bio 5671. Advanced Tutorials in Neural Sciences
Directed readings and discussions for graduate students on selected topics in advanced neural science. Topics and specific instructors to be listed at registration. Each tutorial will last for 6 weeks. Open to all students interested in the Neurosciences program. Credit 1-3 units, depending on how many sessions taken. Offered both in Fall & Spring semesters. J. Cohen (Anatomy/Neurobiology), Staff

Bio 5681. Introduction to Principles of Neuropharmacology
Basic principles of pharmacodynamics, action of drugs affecting the autonomic nervous system, receptor binding, etc. Credit 2 units. E. Johnson (Pharmacology)

Bio 5681. Pathogenesis of Neurologic Diseases
This course will offer an in-depth description of recent scientific advances relevant to the causes of neurologic disease. Lectures will be followed by discussions involving preclinical and clinical faculty members whose research is relevant to the disease being considered. Credit 2 units. Snider (Neurology), Staff

Bio 570. Advanced Biochemistry and Physiology of Plants
Identical to Bio 4136, except for additional readings plus one hour of discussion per week. Credit 4 units. Kobli, Pakrasi, Pickard, Varner (Biology)

Bio 572. Seminar in Plant Biology
Molecular aspects of plant metabolism. Credit 2 units. Staff (Biology)

Bio 575. Advanced Studies in Plant Systematics
Seminars in specific topics, with main emphasis on economic botany. Other topics include anatomy, chemotaxonomy, cytology, ecotaxonomy, embryology, nomenclature, palynology, phytoecography, and bibliography. Credit 1 unit a semester. Lewis (Biology)

Bio 580. Seminar in Population Biology
This weekly seminar, covering topics in species and speciation, will be taken by graduate students in this program each semester. Research and literature reports will be given by staff, visitors, and graduate students. Credit 2 or 3 units. Templeton (Biology)

Bio 581. Seminar in Techniques in Field Biology
Planning and presentation of techniques in selected areas of population biology. Credit 3 units. Sexton (Biology)

Bio 5821. Theoretical Population Genetics
A rigorous introduction to the theoretical basis of population genetics and evolutionary mechanisms. Quantitative genetics, population structure and molecular evolution will be investigated first, followed by an examination of how selection, population structure, and ecological factors interact in determining the evolutionary fate of a population. Credit 3 units. Templeton (Biology)

Bio 5822. Mathematical Ecology
The theory of the Leslie Matrix is developed with respect to population growth, colonization, demography and the evolution of life history attributes. Matrix approaches are used to study species interactions and communities. Finally, the use and limitations of optimization models in ecology are discussed. Credit 2 units. Templeton (Biology)
Bio 583. Plant Systematics Workshop
A series of workshops, each consisting of laboratories and tutorials: (1) monographic studies; (2) cytotechnology; (3) palynology; (4) microtechnique; (5) chemosystematics. Credit 1 unit. Hoch (Biology)

Bio 5841. Plant Population Biology
Theoretical and experimental aspects of plant population genetics and ecology. Topics include the genetic structure of native plant species, demography, life-history evolution, coevolution, and species-species interactions. Credit 3 units. Schaal (Biology)

Bio 585. Seminar in Floristic Taxonomy
A survey of angiosperm families, their morphology, cytology, anatomy, palynology, chemistry, and evolution. Credit 1 unit. Hoch, Gentry (Biology)

Bio 586. Structure and Composition of Tropical Forests
An introduction to tropical forest ecology and floristics, emphasizing the unique features that make these the most complex ecosystems on earth. Focus on patterns of structural and taxonomic diversity, pollination and dispersal biology, floristic composition, and the recognition of the distinguishing features of major tropical forest plant taxa. Credit 2 units. Gentry (Biology)

Bio 587. Phytogeography
An introduction to the current and past geographical distributions of plants, emphasizing ecological, geological, and historical factors. Credit 3 units. Gentry (Biology)

Bio 588. Molecular Evolution
An investigation of the patterns and processes of molecular evolution with emphasis on proteins and nucleic acids. Topics include neutrality theory, molecular systematics, phenotypic manifestations of molecular evolutionary phenomena, evolution of transposable elements and retroviruses, evolution of multigene families, and chromosomal evolution. Credit 3 units. Larson, Schaal, Templeton

Bio 590. Research
Credit to be arranged. Staff (Biology)

Bio 5911. Seminar in Biology and Biomedical Sciences
These seminars cover the recent literature in various areas not included in other courses, or in more depth than other courses. Credit to be arranged. Staff (Biology)

Note- The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.
PROGRAM IN BIOMEDICAL ENGINEERING

This course of graduate study is designed to provide education and training for students wishing to apply principles of modern engineering and mathematics to theoretical and practical problems in biology and medicine. Students and faculty of both the School of Engineering and Applied Science and the School of Medicine participate in the program.

Every student seeking an advanced degree in engineering must be admitted to one of the participating departments of the Sever Institute of Technology, the graduate division of the School of Engineering and Applied Science. The program permits the student to earn a certificate in biomedical engineering in addition to the M.S. or D.Sc. degree in a chosen engineering field. Students who are not candidates for a degree are welcome to take courses as electives.

Graduate study plans are tailored to the individual's needs and interests, and provide essential background in the related areas of life and medical sciences. Students with diverse undergraduate backgrounds may be admitted provided they have adequate preparation and experience in mathematics and the physical sciences. Areas of specialization include sensory communications, electrocardiography, flow and diffusion in biological systems, electrophysiology, technology in health care, modeling of biological systems, engineering of artificial organs, drug concentration control, and applications of advanced computer techniques to biology and medicine. Research facilities available to the program are located in the School of Engineering and Applied Science, the School of Medicine, and the Washington University Computer Laboratories. The faculty includes representatives from the Biomedical Computer Laboratory, the Departments of Biological Chemistry, Cell Biology and Physiology, Radiology, and Anatomy and Neurobiology in the School of Medicine, and the Departments of Computer Science, Chemical, Civil, Electrical, and Mechanical Engineering in the School of Engineering and Applied Science.

Complete course listings and information about application and degree requirements may be found in the Bulletin of the School of Engineering and Applied Science.

Biomedical Engineering course offerings:

**BMed 502. Mathematical Methods in Biophysics**

**BMed 547. Biological Mass and Momentum Transfer**

**BMed 560. Biomechanics**

**BMed 576. Sensory Communications**

**BMed 582. Biophysical Measurement**

**BMed 585. Ion Selective Channels in Cell Membranes**

**BMed 600. Research for Doctoral Dissertation**

**BMed 651. Science of Synthetic and Biological Polymers**

**BMed 660. Biomedical Applications of Small Digital Computers**

**BMed 693. Special Topics in Biomedical Engineering**

For additional related courses, see Biomedical Computer Laboratory in this Bulletin and the Bulletin of the School of Engineering and Applied Science.

Faculty

**Professors**

R. Martin Arthur
Jerome R. Cox, Jr.
John L. Kardos
James G. Miller
Charles E. Molnar
William F. Pickard
Marcus E. Raichle
Robert E. Sparks
Salvatore P. Sutera
Michel M. Ter-Pogossian
Gurt Thies
Reimut Wette
George I. Zahalak

**Research Professor**

Kenneth B. Larson

**Associate Professors**

Stuart B. Boxerman
William F. Holmes
Thomas R. Miller
Stanley Misler
Lewis J. Thomas, Jr.
John Wong

**Senior Research Associate**

Norbert S. Mason
HEALTH ADMINISTRATION PROGRAM

The Philosophy
The faculty of the Health Administration Program of Washington University believes that administrative personnel in health organizations require not only a solid foundation in management but also an understanding of those aspects of finance, regulation, and planning unique to the health care field. Additionally, since its inception in 1946, the program has acted on the premise that health administration students would benefit from exposure to the environment in which they will ultimately be involved. To this end the program has maintained an organizational structure consisting of a core faculty located within the School of Medicine, augmented by faculty from other schools and departments within the University, as well as affiliated institutions and agencies. This multi-disciplinary approach enables the student to acquire not only specific management skills but an understanding of the many complexities unique to the health care sector.

Curriculum and Sequence of Study
Required courses constitute 62 percent of the course sequence for the master of health administration degree, offering vital exposure to the generic knowledge in the health administration area. In addition to the elective courses available within the Health Administration Program (HAP), students may take up to 15 semester hours of graduate work in other units of Washington University. The HAP student's faculty adviser must approve the selection of courses in the student's individual curriculum. The student's previous academic work, employment experience, and ultimate performance goals enter into the individual's personalized curriculum.

As a means of furthering interdisciplinary study, up to 15 semester hours of HAP courses are open to interested graduate students from other areas of Washington University. There is also a joint M.H.A.-J.D. degree between the Health Administration Program and the School of Law, a joint M.H.A.-M.B.A. degree between the Health Administration and the graduate school of Business Administration, and a joint M.H.A.-M.I.M. degree between the Health Administration Program and the School of Technology and Information Management. A new degree is a joint degree between the Health Administration Program and the George Warren Brown School of Social Work (M.H.A.-M.S.W.) and currently under development a joint degree with the School of Arts and Sciences in Human Resource Management (M.H.A.-M.A.) in Human Resources Management through University College.

The sequence of study requires two years, each consisting of a fall and spring semester. Upon completion of the four semesters, or a total of 60 units, the student will receive a master of health administration (M.H.A.) degree conferred by Washington University. The statute of limitations is five years from the date of matriculation to complete all requirements for the M.H.A. degree. Contingent upon graduation the student has the option of pursuing a 12-month postgraduate administrative fellowship. A certificate will be awarded by Washington University School of Medicine and the affiliated fellowship organization upon completion of the fellowship.
Administrative Fellowship

The 12-month optional postgraduate administrative fellowship will be served in a hospital, health agency, or health organization which has been recommended and approved by the full-time faculty. This option is available only to those persons who have the M.H.A. degree conferred upon them by Washington University. The purpose of the fellowship is to provide the graduate with an opportunity to observe and practice those concepts and principles learned during the didactic on-campus exposure. The administrative fellowship is strongly recommended, as this postgraduate clinical exposure is deemed necessary for adequate professional career preparation. The fellowship is completed under the direction of a well-qualified and experienced health care administrator who is given an annual adjunct faculty appointment at Washington University School of Medicine.

The full-time faculty maintains close liaison with the administrative fellow and the preceptor. An educational plan which outlines the fellow’s resident’s activities for the coming year must be filed by the preceptor. The preceptor also sends two evaluation reports to the Director of HAP and shares the responsibility for recommending awarding of the certificate by Washington University School of Medicine and the fellowship site organization.

Within available resources an on-campus faculty member visits the site to meet with the preceptor and resident. HAP also sponsors an annual preceptors conference at Washington University. Interaction of these site and campus visits enables joint review of the resident’s progress, as well as evaluation and refinement of the administrative fellowship experience.

Admission Requirements

Washington University’s Health Administration Program is committed to nondiscriminatory practices in selection of applicants regarding race, sex, age, religion, or national origin. The faculty and staff are affirmatively committed to recruiting, enrolling, and educating students from minority groups who have the potential for graduate study.

A minimum of a bachelor’s degree from an accredited university or college acceptable to Washington University School of Medicine is required, as is completion of the Graduate Record Examination (Aptitude Test) or the Graduate Management Aptitude Test. No specific undergraduate major field of study is required for admission into the program; however, introductory courses in accounting, economics, statistics (or their equivalents), and mathematics through college algebra are very strongly recommended.

Tuition per semester $7,250
Books and supplies (per semester) 525
Application fee (nonrefundable) 30

“B” Electives Health Administration

As a specialty, health administration (HA) looks at medical care from an institutional and organizational perspective. Rational health administration requires expert knowledge in many areas including: law, finance, planning, and organizational behavior.

The goals of this six-week elective are:
1. An overview of the specialty of health administration.
2. Firsthand contact with selected local institutions and their administrators.
3. Investigation of particular subjects of interest.

The purpose of the elective is not to make administrators out of physicians. Rather it is anticipated at the end of the six weeks that the student will be able to communicate with those persons who see medicine from an organizational viewpoint.
Faculty

Professor and Director
James O. Hepner, Ph.D.,
University of Iowa, 1964.

Professor

Associate Professor and Deputy Director
Stuart B. Boxerman, D.Sc.,
Washington University, 1970.

Associate Professor and Associate Director/Research
Robert S. Woodward, Ph.D.,
Washington University, 1972.

Associate Professors (Adjunct)

Wayne M. Lerner, D.P.H.,
University of Michigan, 1988.

Assistant Professors
Ronald E. Gribbins, Ph.D.,
University of Wisconsin, 1975.
Robert J. Hickok, M.H.A.,
Washington University, 1971. (See Administration and Program in Physical Therapy.)

Assistant Professors (Adjunct)
Frank S. Groner, L.L.D., East
Texas Baptist College, 1946.
Boone Powell, Sr., L.L.D., Baylor
University, 1958.
Mary R. Rocklage, M.H.A., St.
Louis University, 1963.

Instructors (Adjunct)
Richard M. Abell, M.H.A.,
Washington University, 1972.
Lee A. Bernstein, M.H.A.,
Washington University, 1980.
Edgar V. Borgenhannmar, Ph.D.,
University of California, Berkeley, 1972.
Frederick L. Brown, M.H.A.,
George Washington University, 1966.
L. Gerald Bryant, M.H.A.,
Washington University, 1968.
John T. Carson, M.H.A., Georgia
State University, 1975.
Keith W. Curtis, Ph.D., University
Jeptha W. Dalston, Ph.D.,
University of Oklahoma, 1970.
Stephen Dorn, M.H.A., St. Louis
University, 1958.
John T. Farrell, M.H.A., St. Louis
University, 1973.
Max D. Francis, M.H.A.,
Washington University, 1966.
Phillip H. Goodwin, M.H.A.,
Washington University, 1968.
Dennis A. Hall, M.H.A.,
Robert A. Hille, M.A., Baylor University, 1969.
Boone Powell, Jr., M.A., University of California, 1960.


Lecturers
Marlowe W. Erickson, Ph.D., University of Michigan, 1964.
Richard H. Fallon, M.D., Harvard University, 1956.
Merlin E. Lickhalter, B.A., Massachusetts Institute of Technology, 1957.
Miles W. Meyer, Ph.D., Washington University, 1984.


Lecturers (Adjunct)
PROGRAM IN NURSE ANESTHESIA

The Department of Anesthesiology offers a program which prepares registered nurses for employment in the healthcare field of anesthesia. Graduates of the program are eligible for national certification, by examination through the Council on Certification of Nurse Anesthetists.

The Washington University Program in Nurse Anesthesia evolved from an anesthesia school established in 1929 and operated continuously for 54 years under the direction of Barnes Hospital.

The CRNA is a registered nurse whose advanced training enables her/him to provide a specialized nursing service. Participating as a member of the anesthesia care team, the nurse anesthetist renders anesthesia care in its entirety to surgical patients.

The curriculum covers a 24-month period, divided between didactics and clinical practicum. Educational experience is obtained at the Barnes Hospital facilities under the direction of anesthesiologists, certified registered nurse anesthetists, and allied health specialists. Graduates of the program have access to career opportunities throughout the United States. Applicant’s credentials must include: (1) Current and valid Missouri licensure as a registered professional nurse. (2) One year of experience in a critical care area. (3) A bachelor of science degree in nursing.

The program is accredited by the Council on Accreditation of Nurse Anesthesia Educational Programs/Schools and complies with its standards and guidelines.

Program specifics may be obtained from Department of Anesthesiology, Nurse Anesthesia Program, Washington University School of Medicine, Campus Box 8054, 660 South Euclid Avenue, St. Louis, Missouri 63110.

Faculty

Professor and Head of Department of Anesthesiology

Clinical Professor of Anesthesiology
Bernard C. DeLeo, M.D., St. Louis University, 1958.

Program Director
LaVerne J. Will, M.S., Southern Illinois University, Edwardsville, 1980.

Educational Director
**Graduate Programs**

**Program in Occupational Therapy**
The Program in Occupational Therapy prepares students to practice occupational therapy, an applied social and biological science. Professionals trained to be occupational therapists assess and treat individuals whose ability to carry out life tasks has been impaired by chronic disease, injury, birth defects, or the aging process. Through a variety of intervention strategies, these individuals are helped to achieve potential levels of independence or to adapt to their disabilities so that they may lead productive and meaningful lives. To become a successful occupational therapist requires imagination and character, a curiosity and commitment to science, and a desire and ability to work with people.

**Undergraduate Program**
The goal of the bachelor of science program in occupational therapy is to prepare individuals with the knowledge, skills, and attitudes to function as professional occupational therapists. Applicants for transfer must present a minimum of 60 semester hours, including specified prerequisites. There are two entry levels to the baccalaureate degree program: students may enter as junior transfers, or as fourth-year transfers from a Three-Two program. Each candidate for a baccalaureate degree is required to successfully complete the professional curriculum consisting of 65 hours of coursework, which is usually accomplished in four semesters of academic study. Six months of supervised clinical internship is required following graduation.

- Tuition (undergraduate), per semester: $6,562.50
- Fee, Clinical Internship: 1,500.00

**Graduate Program**
The goal of the entry-level master's degree program is to prepare individuals to practice as professional occupational therapists, as well as to provide them with additional knowledge and skills to evaluate practice, engage in educational activities, and plan and execute new programs. Applicants for admission must hold a bachelor's degree or be an approved participant in a Three-Two program, and have completed prerequisites from an accredited college or university.

Each candidate for a master's degree must complete the professional curriculum which consists of 80 hours of coursework, and is usually accomplished in five semesters of academic study (two academic years and the intervening summer). The student must complete teaching and research practica during the five-semester program, as well as a master's project. Six months of supervised clinical internship is required following graduation.

- Tuition (graduate), per semester: $7,087.50
- Fee, Clinical Internship: 1,500.00

**Post Professional Graduate Program**
This program offers a Master of Science degree, with the advanced study of occupational therapy. Goals of this program are for students to access resources to achieve their goals for professional growth, build theoretical foundation and clinical reasoning skills for practice, develop expertise needed for research activities which will refine and expand the knowledge base of occupational therapy, and develop skills for professional development into advanced practice and leadership roles in the profession. Students are allowed to select course work to match career goals and interests through options in practice tracks, specialty courses, and electives. Admission is open to qualified applicants with a baccalaureate degree in Occupational Therapy with current certification from the American Occupational Therapy Certification Board (AOTCB). This program requires completion of 36 semester credits, offered in an evening part-time format. It is anticipated that this program may be completed within three years of study.

- Tuition per credit hour: $250

For further information, contact the Program in Occupational Therapy, Campus Box 8066, 4567 Scott Avenue, St. Louis, Missouri 63110. Phone: (314) 362-6911.
Faculty

Associate Professor and
Elias Michael Director
M. Carolyn Baum, M.A., Webster
College, 1979.

Associate Director of
Undergraduate Program and
Instructor
Patricia LaVesser, M.A., Webster
University, 1987.

Associate Director of Clinical
Services and Instructor
Diane Barnes, B.S., University of

Coordinator of Graduate
Program and Instructor
Peggy Strecker Neufeld, M.A.,
New York University, 1976.

Coordinator of Fieldwork
Education and Instructor
Karen Barney, M.S., University of
Wisconsin, 1982.

Coordinator of Recruitment
and Instructor
Claudia Hilton, M.B.A., University
of Evansville, 1986.

Associate Director and
Instructor
Catherine Rose, M.A., Washington
University, 1992.

Associate Professor
C. Robert Almli, Ph.D., Michigan
State University, 1970.

Assistant Professors
Janet Duchek, Ph.D., University of
South Carolina, 1982.
Dorothy F. Edwards, Ph.D.,
Washington University, 1980.
Christine Feely, Ph.D., Washing-
ton University, 1984.
Marc H. Schieber, M.D., Ph.D.,
Washington University, 1982.

Research Assistant
Professor
Lucy Jane Miller, Ph.D., University

Instructors
Harriet A. Backhaus, M.A.,
Webster University, 1992.
Christine Berg, M.S., Boston
University, 1979.
Mary Bettlach, M.P.H., St. Louis
University, 1992.
Mary Evert, M.B.A., National
University, 1980.
Roberta Geis, B.S., University of
Oklahoma, 1980.
Ronald Gribbins, Ph.D., Univer-
sity of Wisconsin, Madison, 1975.
Paul Groszewski, M.S., Washing-
ton University, 1989.
Linda Hunt, M.S., Washington
University, 1991.
Luci Kohn, Ph.D., University of
Leonard Matheson, Ph.D.,
University of Southern California,
1979.
Nancy Mohr, M.S., Washington
University, 1989.

Monica Perlmutter, M.A.,
Washington University, 1989.
Erin Casey Phillips, M.S.,
Susan Rhomberg, M.A., Wash-
ington University, 1991.
Mary Seaton, B.S., University of
Missouri, 1977.
Barbara Sopp, M.S., National

Lecturers
Tina Batzer, B.S., University of
Cheryl Burton, M.S., National
Demetra Davis, B.S., University of
Paul Ellis, M.S., St. Louis
University, 1982.
Susan Stark, M.S., Washington
University, 1989.
Stephanie Urban, B.S., Wash-
ington University, 1985.
Betty Ring, M.S., Tel Aviv
University, 1978.
Mary Tubbs, B.S., Washington
University, 1985.
Marsha Weisel, B.S., Ohio State
University, 1983.
PROGRAM IN
PHYSICAL THERAPY

The Program in Physical Therapy at the School of Medicine offers an intensive two and one-half year curriculum which leads to the degree of Master of Science in Physical Therapy. Applicants for admission must have completed: 1) a baccalaureate degree at an accredited college or university and 2) prerequisite courses in English, psychology, biology, mathematics, physics, chemistry and social sciences.

The study of human movement — both normal and abnormal — forms the core of the curriculum. Competence in clinical practice results from integrating information learned from courses in basic science, clinical science, and from applying this information to actual practice. Students develop the ability to assess, remedy, and prevent movement disorders for a wide variety of patient care problems. The goals of the curriculum are to prepare individuals for the profession of physical therapy who (1) have attained the competencies of an entry-level, science based, general practitioner, (2) are prepared to accept their professional responsibilities, and (3) are committed to a life-long career.

The Program seeks to prepare students for both the current and future practice of physical therapy. The faculty actively participates in clinical practice, research and curriculum development to enhance and influence the direction of the profession. Students are provided with an environment in which both clinical and academic faculty assist them to achieve their highest personal and professional potential.

Tuition per semester  $6,825
Clinical Education Fee  400

Further information may be secured by direct correspondence with the Program in Physical Therapy, Campus Box 8083, 660 South Euclid Avenue, St. Louis, Missouri 63110.
Graduate Programs

Faculty

Assistant Professor and
Director
Susan S. Deusinger, Ph.D.,

Associate Professor Emeritus
Beatrice F. Schulz, M.A.,
Washington University, 1955.

Assistant Professor Emeritus
Lorraine F. Lake, Ph.D.,
Washington University, 1962.

Associate Professor
Shirley A. Sahrmann, Ph.D.,
Washington University, 1973. (See
Departments of Neurology and
Neurological Surgery and Cell
Biology and Physiology.)

Visiting Associate Professor
Eugene Michels, M.A., University

Assistant Professors
Marybeth Brown, Ph.D., University
of Southern California, 1984.
Robert H. Deusinger, Ph.D., The
University of Iowa, 1981.
Robert J. Hickok, M.H.A.,
Washington University, 1971. (See
Administration and Health Adminis-
tration Program.)
Scott D. Minor, Ph.D., University

Adjunct Assistant Professor
Anthony Delitto, Ph.D., Washing-
ton University, 1990.

Instructors
Gail W. Baudendistel, M.S., St.
Louis University, 1977.
Cheryl Caldwell, M.H.S./P.T.,
Washington University, 1989.
Ruth Clark, Ph.D., St. Louis
University, 1988.

Suzanne M. Cornbleet, M.A.,
Jay Diamond, M.H.S./P.T.,
Washington University, 1989.
Kathleen Dixon, M.Ed., Johns
Hopkins University, 1969.
Wendy M. Kohrt, Ph.D., Arizona
State University, 1986.
Mary Kate McDonnell, M.H.S./
Michael Mueller, M.H.S./P.T.,
Washington University, 1985.
Barbara J. Norton, M.H.S./P.T.,
Washington University, 1984.
Marc H. Schieber, M.D., Ph.D.,
Washington University, 1982.
David R. Sinacore, Ph.D.,
University of West Virginia, 1991.
Jennifer S. Stith, M.S., Universi-
dy of Southern California, 1978.
Janet A. Tenhula, M.H.S./P.T.,
O.C.S., Washington University,
1986.
Linda Van Dillen, M.H.S./ P.T.,
Washington University, 1985.
Nancy B. Woolsey, M.S.,
Washington University, 1979.

Lecturers
Kathleen Haralson, M.A.,
Washington University, 1989.
Patricia Kohne, B.S., Washington
University, 1985.
Richard C. Lehman, M.D.,
University of Miami, 1980.
Kathleen McDonald, B.A.,
Susan Priem, B.S., Mankato State
University, 1987.
Jeanine Schierbecker, B.S.,
Washington University, 1982.
LuAnn F. Smith, B.S., University
Susan Strecker, B.S., University of
Kansas, 1980.
Tamara Versluis, B.S.,

Instructors (Clinical)
Brenda Allen
Steve Allen
Cindy Alvino
Gerald Appelhans
Dan Arnold
Michele Audet
Kristy Azbell
Karen Bachman
Debbie Baldwin
Connie Banning
Pat Barbier
Lisa Barker
Noemi Barroga
Sarah Baumgartner
Dana Beggs
Susan Barr Black
Jocelyn Blaskey
Jeanne Boardman
Amy Bodkin
Kathy Braun
Capt. Kathleen Brehm-Heiman
Sylvia Brothers
Bill Brown
Laura Brown
Paula Burnett
Pam Bustamante
Linda Butler
Mary Campain
Susan Cannon
Barbara W. Carroll
Terri Casey
Steve Cassabaum
Paulette Cebulski
Ann Charness
Diane Chartrau
Mary Beth Churbuck
Mike Gibson
Sherry Clark
Terri Codd
Ann Conklin
Betsy Cook
Tammy Coughlin
Roger Covey
Susan Crabtree
Sue Crawford
Laura Croix (interim)
Arlene Crouther
Duane Scott Davis
Chris Haug Deans
Liz DeBernardi
Brett Derrick
Steven Dickoff
Jeff Dobbins
John Dooley
Sue Drecktrah
Mary Ellen Dubois
Kevin Duffy
Sandra Duniven
Chris Easley
Russ Eaves
Beverly Edge
Suzanne Edwards
Heidi Eigsti
Betsy Elsaesser
Marilyn Engmann
Shawn Everson
On January 7, 1987, the Executive Faculty acted to discontinue the Department of Preventive Medicine and Public Health. Programs and Faculty of the department are listed separately or have been assigned to other departments.

Professors Emeriti of Preventive Medicine and Public Health
C. Howe Eller (Public Health), M.D., University of Colorado, 1930; Ph.D., Johns Hopkins University, 1934.

Robert E. Shank, M.D., Washington University, 1939. (See Department of Medicine.)

Danforth Professor of Preventive Medicine and Public Health
M. Kenton King, M.D., Vanderbilt University, 1951. (See Department of Medicine.)

HEALTH CARE SERVICES PROGRAM
The Health Care Services Program at Washington University responds to the growing need for multidisciplinary professionals with expertise in the planning, implementation, and evaluation of health service programs. Sponsored jointly by Washington University's School of Medicine, Department of Psychology, and University College, this 30-unit graduate degree program draws on the broad expertise of University faculty and research personnel. The curriculum examines organizational influences important to the development of innovative programs for individuals and families, stressing health education and the application of current research findings.

Professionals with bachelor’s degrees from various disciplines (such as dietetics, education, nursing, occupational therapy, physical therapy, psychology, social sciences, social work, and other related fields) may apply to the program. The Master of Health Science degree can be pursued on a part-time basis with most courses held during the late afternoon or evening hours to accommodate the working professional. Students may select electives from various departments and divisions of the University (health administration, social work, psychology, human resources management).

Faculty
Co-Directors
Edwin B. Fisher, Jr., Ph.D.
Professor of Psychology
Director, Center for Health Behavior Research
Julio V. Santiago, M.D.
Professor of Pediatrics

Associate Director
Debra L. Haire-Joshu, Ph.D.
Associate Director, Demonstration and Education Component, Diabetes Research and Training Center

Program Coordinator
Cheryl A. Houston, M.S., R.D.
Instructor, Health Care Services Center for Health Behavior Research

Associate Professors
Kenneth B. Schechtman, Ph.D.
(Biostatistics)
Neil White, M.D.
(St. Louis Children’s Hospital)

Assistant Professors
Wendy Auslander, Ph.D.
(George Warren Brown School of Social Work)
Janet B. McGill, M.D.
(Metabolism)

Research Assistant Professors
Cynthia Arfken, Ph.D.
(Center for Health Behavior Research)
Linda K. Sussman, Ph.D.
(Center for Health Behavior Research)

Program Instructors
Joan Heins, M.A., R.D., C.D.E.
(Center for Health Behavior Research)
Jan Munro, M.Ed.
(Center for Health Behavior Research)
Carol Stubblefield, M.S.N.
(Jewish Hospital School of Nursing; Center for Health Behavior Research)

Adjunct Instructors
Carol Dyer, M.A.
(Psychology)
Jeffrey Gavard, Ph.D.
(Center for Health Behavior Research)
Sharon Pontious, Ph.D.
(Jewish Hospital School of Nursing)
Donald Richert, Ph.D.
(St. Louis College of Pharmacy)
MASTERS PROGRAM IN PSYCHIATRIC EPIDEMIOLOGY (MPE)

This program prepares post-doctoral fellows and a select group of pre-doctoral students for an active research career in psychiatric epidemiology. Students develop research skills, and learn basic epidemiological methods. They study the history of development of various psychiatric diagnostic systems, the history of psychiatric epidemiology, and they become familiar with the commonly used diagnostic interviews and questionnaires. They also become familiar with computer statistical packages and become competent in data analysis.

Advanced students may be given credit for similar courses taken elsewhere. Each student selects a mentor who is responsible for guiding him or her in research activities. Students present research findings at scholarly meetings and in journal articles and learn to write grant proposals. They serve as constructive critics of the published and submitted work of other researchers and become sensitive to ethical issues in cross-sectional and longitudinal epidemiological research. Students' time is divided between formal courses and research apprenticeships, with the greater emphasis on the latter. Students participate in various stages of on-going studies: instrument development, study design, interviewer training, sample selection, data collection and management, designing and carrying out data analysis, and literature reviews.

The degree of Master of Psychiatric Epidemiology (MPE) is typically earned in two years (five semesters, including one summer).

Faculty

Professor and Director
Lee N. Robins (University Professor of Social Science and Professor of Social Science in Psychiatry)

Professors
Theodore J. Cicero (Neuropharmacology)
C. Robert Cloninger, Head, Department of Psychiatry (Psychiatry)
Dabeeru C. Rao (Biostatistics)
Theodore Reich (Psychiatry)
John P. Rice (Mathematics in Psychiatry and Biostatistics)
Edward L. Spitznagel, Jr. (Biostatistics)
J. Philip Miller (Biostatistics)

Associate Professors
Andrew C. Heath (Psychology in Psychiatry)
Collins E. Lewis (Psychiatry)
Gregory A. Storch (Medicine and Pediatrics)

Research Associate Professor
Elizabeth M. Smith (Social Work in Psychiatry)

Assistant Professors
Linda B. Cottler (Epidemiology in Psychiatry)
Carol S. North (Psychiatry)
George P. Vogler (Biostatistics)

Research Assistant Professors
Kathleen K. Bucholz (Epidemiology in Psychiatry)
Mae Gordon (Ophthalmology and Visual Sciences)
Gwendolyn G. Reich (Anthropology in Psychiatry)

Research Instructor
Cynthia Arfken (Biostatistics)
ADMINISTRATION

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Roma Broida Wittcoff

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Richard K. Weil
Margaret Bush Wilson

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Robert L. Virgil
Executive Vice Chancellor for University Relations and Dean, John M. Olin
School of Business
Richard E. Anderson
Vice Chancellor for Administration and Finance
David T. Blasingame
Vice Chancellor for Alumni and Development Programs
William A. Peck
Vice Chancellor for Medical Affairs and Dean
M. Frederic Volkman
Vice Chancellor for Public Affairs
Gloria W. White
Vice Chancellor for Human Resources
Martin H. Israel
Dean of the Faculty of Arts and Sciences

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Treasurer

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William H. Danforth, M.D.
Chancellor
Edward S. Macias, Ph.D.
Provost
William A. Peck, M.D.
Vice Chancellor for Medical Affairs and Dean
Theodore J. Cicerella, M.D.
Associate Vice Chancellor, Associate Dean for Animal Studies
Donald Clayton
Associate Vice Chancellor for Medical Public Affairs
James P. Crane, M.D.
Associate Vice Chancellor for Clinical Affairs, Associate Dean of the School of Medicine
Lee F. Fetter, M.Ed.
Associate Vice Chancellor, Associate Dean for Administration and Finance, and Chief Operating Officer
Thomas R. Sonderegger, M.B.A.
Assistant Vice Chancellor for Program and Financial Planning, Assistant Dean
G. Michael Timpe, M.B.A.
Assistant Vice Chancellor, Assistant Dean for Special Projects
Morton E. Smith, M.D.
Associate Dean for Continuing Medical Education and Post-Graduate Education
Patricia L. Cole, M.D.
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Clinical Representative to the Executive Committee of the Faculty Council
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Clinical Representative to the Executive Committee of the Faculty Council
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² Representing the Faculty Council during 1992-93.
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Marc Schieber
Harry Swanger

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Selected faculty members

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Selected faculty members

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Chairman
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Harvey S. Glazer
Mary L. Graham
Perry W. Grigsby
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Marshall Hicks
Lawrence I. Kahn
Michael M. Karl
Helen Kornblum
Robert Lee
William H. McAllister
Sheila Michalski
Scott Minor
Leonard Naeger
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Judith Schulte
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Barry A. Siegel
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Liza Streett
Leslie Strohm
Lloyd Vasquez
Kathryn Vehe
Richard D. Wetzel
Laurel Wiersema
Glenda Wiman
Gary R. Zuckerman
John Zuzack
Leonard Berg
Alternate
Deborah J. Gersell
Alternate
Mark R. Wick
Alternate

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Eugene M. Johnson, Jr.
Marion Peters

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PLACEMENT AND CURRICULUM COMMITTEE (MSTPCC)

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Patricia L. Cole
Rosalind H. Kornfeld
John L. Schultz
ex officio
Thomas A. Woolsey
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*Program Director*
Elliot L. Elson  
*Program Co-Director*
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Ted H. Hansen
Henry V. Huang
Ellen Li
Joseph P. Miletich
John H. Russell
Arnold N. Strauss
Douglas M. Tollefsen
Thomas A. Woolsey
John L. Schultz  
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*Vice Chairman*
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David Apirion
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Harry Leahey
Stephen M. Moerlein
James A. Purdy
Joseph L. Roti Roti
Lee Sobotka
Michael J. Welch
Joseph R. Williamson
Susan E. Cullen  
*Alternate*

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*Chairman*
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*Vice Chairman*
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Michael J. Welch
### REGISTER OF STUDENTS

#### DOCTOR OF MEDICINE AND DOCTOR OF PHILOSOPHY DEGREES

**Medical Scientist Training Program**

**Graduating Class—May 15, 1992**

<table>
<thead>
<tr>
<th>Name</th>
<th>City, State</th>
<th>Degree Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baker, Keith Harold</td>
<td>Tequesta, FL</td>
<td>B.S., M.S., Emory University, '85 Medicine - Preliminary</td>
</tr>
<tr>
<td>Baranski, Thomas John</td>
<td>Menomonie Falls, WI</td>
<td>B.S., University of Wisconsin, Madison, '85 Internal Medicine</td>
</tr>
<tr>
<td>Carnes, Kenneth Michael</td>
<td>North Hollywood, CA</td>
<td>B.S., Brown University, '84 Medicine - Preliminary</td>
</tr>
<tr>
<td>Desai, Sanjay Arvind</td>
<td>Greenwood, SC</td>
<td>B.S.E., Duke University, '85 Internal Medicine</td>
</tr>
<tr>
<td>Hazen, Stanley Leon</td>
<td>Hamilton, OH</td>
<td>B.A., Washington University, '85 Internal Medicine</td>
</tr>
<tr>
<td>Hershey, Andrew Dean</td>
<td>Newton, IA</td>
<td>B.S., University of Iowa, '85 Pediatrics</td>
</tr>
<tr>
<td>Hershey, Gurjit Kaur Khurana</td>
<td>Iowa City, IA</td>
<td>B.S., University of Iowa, '85 Pediatrics</td>
</tr>
<tr>
<td>Hillier, David Alfred</td>
<td>Stanford, CA</td>
<td>B.A., B.S., Swarthmore College, '84 Medicine - Preliminary</td>
</tr>
<tr>
<td>Kennedy, Charlotte Justine Roberts</td>
<td>Clemson, SC</td>
<td>B.A., Agnes Scott College, '84 Internal Medicine</td>
</tr>
<tr>
<td>Martin, David Patrick</td>
<td>Kokomo, IN</td>
<td>B.S., Indiana University, '85 Transitional</td>
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<tr>
<td>Moon, Anne Marguerite</td>
<td>Nevada, IA</td>
<td>B.S., University of Iowa, '84 Pediatrics</td>
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<td>Thio, Kwee Liu Lin</td>
<td>Marietta, GA</td>
<td>Sc.B., Brown University, '84 Pediatrics</td>
</tr>
<tr>
<td>Watson, Mark Allan</td>
<td>Berkeley Heights, NJ</td>
<td>B.A., University of Pennsylvania, '85 Laboratory Medicine</td>
</tr>
<tr>
<td>Westervelt, Peter</td>
<td>Waterville, ME</td>
<td>B.A., Colby College, '85 Internal Medicine</td>
</tr>
<tr>
<td>Zupan, Andrew Anton</td>
<td>Columbus, OH</td>
<td>B.A., Washington University, '84 Pediatrics</td>
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#### Sixth-Year Trainees 1991-92

<table>
<thead>
<tr>
<th>Name</th>
<th>City, State</th>
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<tbody>
<tr>
<td>Amatruda, James Francis</td>
<td>Woodbridge, CT</td>
<td>B.A., Harvard University, '86</td>
</tr>
<tr>
<td>Cantor, Alan Bruce</td>
<td>East Northport, NY</td>
<td>B.A., Cornell University, '85</td>
</tr>
<tr>
<td>Glaser, Paul Edward</td>
<td>Euclid, OH</td>
<td>B.S., M.S., The University of Chicago, '86</td>
</tr>
<tr>
<td>Goodkin, Howard Parker</td>
<td>Sierra Madre, CA</td>
<td>B.S.E., University of Pennsylvania, '85</td>
</tr>
<tr>
<td>Kolodney, Michael Spencer</td>
<td>Fair Lawn, NJ</td>
<td>B.S., Massachusetts Institute of Technology, '86</td>
</tr>
<tr>
<td>Matheny, Cali Christine</td>
<td>Portales, NM</td>
<td>B.S., Eastern New Mexico University, '86</td>
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<tr>
<td>Green, Rebecca Paula</td>
<td>Davenport, IA</td>
<td>B.S., University of Iowa, '83</td>
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<tr>
<td>Solomon, Joel Stuart</td>
<td>Shaker Heights, OH</td>
<td>B.A., The Johns Hopkins University, '84</td>
</tr>
<tr>
<td>Weiner, Scott J.</td>
<td>Lafayette Hill, PA</td>
<td>A.B., Harvard University, '84</td>
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#### Post-First-Year Trainees 1991-92

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<td>Manitowoc, WI</td>
<td>B.S., Massachusetts Institute of Technology, '85</td>
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<td>Zempel, John Martin</td>
<td>Elkhorn, WI</td>
<td>B.S., University of Wisconsin, '85</td>
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</tbody>
</table>
Ross, Theodora Suzanne
Kalamazoo, MI
B.A., Kalamazoo College, '85

Schlaggar, Bradley Lorin
Wilmette, IL
Sc.B., Brown University, '86

Simon, David K.
Evanston, IL
B.A., The Johns Hopkins University, '86

Strauss, Brian Louis
Millville, NJ
B.S., Massachusetts Institute of Technology, '86

VanDeerlin, Vivianna M. D.
Chicago, IL
B.S., M.S., The University of Chicago, '86

Young, Robert Lindsay
San Jose, CA
B.S., A.B., Stanford University, '86

Fifth-Year
Trainees 1991-92

Chiara, David Carl
Redding, CA
B.S., University of California, Davis, '84

Filiaggi, Maria Chiara
Glen Ellyn, IL
A.B., Washington University, '87

Girard, William Philip
Westbrook, ME
B.A., Colby College, '87

Godambe, Sandip Ashok
Lisle, IL
B.A., Washington University, '87

Hanson, Robin Dale
Minneapolis, MN
B.A., The Johns Hopkins University, '85

Heusel, Jonathan William
Lincoln, NE
B.S., University of Nebraska, '87

Hsu, Benjamin Li- ping
Gaithersburg, MD
B.A., Harvard College, '86

Hug, Christopher
Cincinnati, OH
B.S., B.A., University of Cincinnati, '87

Jay, Patrick Yin Kan
San Jose, CA
B.S., Stanford University, '87

Joslin, Gregory
Jamaica Plain, MA
B.S., University of Massachusetts, Boston, '87

Lee, Katherine Ann
Skaneateles, NY
B.A., Carleton College, '86

Leonis, Michael Anthony
Las Vegas, NV
B.A., Washington University, '87

Myers-Powell, Brenda A.
Pt. Washington, MD
B.S., The Johns Hopkins University, '87

Niederman, Thomas M. J.
Los Angeles, CA
B.S., University of California, Los Angeles, '87

Porter, Brenda Elaine
St. Louis, MO
B.S., Washington University, '87

Rudnick, Caroline Marie
Mt. Clemens, Mi
B.S., Duke University, '87

Rudnick, David Alan
Champaign, IL
B.S., University of Illinois, '87

Silbert, Seth Cheng
Clayton, MO
B.S., Harvard University, '86

Tarle, Ivan
Novi Sad, Yugoslavia
B.S., California Institute of Technology, '87

Veis, Deborah Jean
Skokie, IL
B.A., Princeton University, '87

Velleca, Mark Albert
New Haven, CT
B.S., Yale University, '85

Wilson, Thomas Edward
Madison, WI
B.S., University of Wisconsin, Madison, '87

Fourth-Year
Trainees 1991-92

Aiken, Kimberly Dawn
Burlington, WI
B.S., University of Wisconsin, '87

Beck, Anita Elizabeth
Troy, OH
B.S., Massachusetts Institute of Technology, '88

DuBois, Brian W.
San Diego, CA
B.A., University of California, San Diego, '88

Glickman, Jonathan
Scarsdale, NY
B.S., Yale University, '87

Johnson, Donald Russell
Columbus, OH
B.A., Ohio State University, '87

Lee, Stephen Luming
Westerville, OH
B.A., Washington University, '88

Roberts, Charles Mortimer
Madison, WI
B.S., University of Wisconsin, '88

Sachais, Bruce S.
Florham Park, NJ
B.A., Lehigh University, '88

Salaro, Christopher Ross
Mariemont, OH
B.S., Northwestern University, '88

Striker, Robert Todd
Cincinnati, OH
B.S., Purdue University, '88

Tykodi, Scott Simon
South Dartmouth, MA
B.A., Northwestern University, '88

Warshawsky, Ilka Ruth
West Bloomfield, MI
B.A., Brandeis University, '88

Third-Year
Trainees 1991-92

Alvarez, John David
Mechanicsburg, PA
B.S., Pennsylvania State University, '89

Bullock, Eric Daniel
Ankeny, IA
B.S., University of Iowa, '89

Chu, Gerald Chen
Osweego, NY
B.A., Cornell University, '89

Colman, Howard
Irvin, CA
Sc.B., Brown University, '89
Colvin, Jennifer Susan  
Towson, MD  
A.B., Harvard University, '87

Dighe, Anand Shrikant  
B.S., Massachusetts Institute of Technology, '89

Gallagher, Martin  
Palos Park, IL  
B.S., University of Notre Dame, '89

Greenlund, Andrew Christopher  
Nevada, MO  
B.S., Southern Methodist University, '89

Greenlund, Laura Schwarze  
Rochester, MN  
B.S., University of Wisconsin, '89

Hermiston, Michelle E.  
Durant, IA  
B.S., University of Iowa, '88

Hodsdon, Michael Edwin  
Bloomington, IN  
B.S., Indiana University, '89

Kotzbauer, Paul Thomas  
Cincinnati, OH  
B.S., Northwestern University, '89

McCoy, Roderick Lawrence  
Santa Monica, CA  
B.S., Stanford University, '89

Mathews, Gregory Christopher  
Berkeley Heights, NJ  
B.S., Georgetown University, '89

Moscoso, Lisa Mae  
Medford, WI  
B.S., University of Wisconsin, '89

Norris, Andrew William  
Olathe, KS  
B.S., Massachusetts Institute of Technology, '89

Rogers-Rovira, Howard  
Wooding  
Newbury, MA  
B.S., Harvard University, '89

Wu, Justina Eng Hui  
Westminster, CA  
B.S., University of California, Irvine, '89

York, Sally Jane  
Hopewell, NJ  
B.S., University of Iowa, '86

Second-Year Trainees 1991-92

Ardelt, Agnieszka Anna  
West Lafayette, IN  
B.S., Purdue University, '89

Bhatnagar, Rajiv Sahai  
Burlingame, CA  
B.S., A.B., University of California, Berkeley, '89

Bry, Lynn Virginia  
Hilton Head Island, SC  
B.A., Cornell University, '90

Chan, Iris Tanchi  
Jamaica, NY  
Sc.B., Brown University, '90

Cheng, Judy Mary  
Hoffman Estates, IL  
B.S., University of Michigan, '89

Culican, Susan Margaret  
Frederick, MD  
B.A., Washington University, '90

Darrow, Bruce Jonathan  
White Plains, NY  
B.S., Yale University, '90

Fogg, George Chee-Chiu  
Littleton, CO  
A.B., Cornell University, '90

Gubitose, Rose Anne  
Euclid, OH  
B.S., Washington University, '90

Hsieh, Chyi-Song  
Carbondale, IL  
B.S., M.S., University of Chicago, '90

McCarter, James Philip  
Northfield, IL  
A.B., Princeton University, '89

Martin, Tod Andrew  
Carbondale, IL  
B.A., Vanderbilt University, '90

Parker, Ian Chase  
Brooklyn, NY  
B.S., Cornell University, '87

Pinckard, James Keith  
Tucson, AZ  
B.S., University of Arizona, '90

Reid, Christopher Brian  
West Point, NY  
B.S., U.S. Military Academy, '90

Schreiber, Matthew A.  
Cleveland Heights, OH  
B.S., Case Western Reserve, '88

Seydel, Karl Boynton  
Redwood City, CA  
B.S., M.S., Stanford University, '89

Wolf, Matthew Joseph  
Dunwoody, GA  
B.A., Washington University, '90

Ying, Howard Shann-Cherng  
Tampa, FL  
B.S., The Johns Hopkins University, '89

First-Year Trainees 1991-92

Alvey, Justin Charles  
Salt Lake City, UT  
B.S., University of Utah, '91

Benveniste, Ronald J.  
Miami Beach, FL  
B.S., University of Miami, '91

Cook, James Robert  
Marietta, GA  
B.S., Pennsylvania State University, '91

Dang, Quoc D.  
Wichita, KS  
B.S., University of Tulsa, '91

Feiz, Vahid  
Ames, Iowa  
B.S., M.S., Iowa State University, '91

Kaplan, Daniel Harry  
Nashville, TN  
B.S., Yale University, '91

Kulesza, Piotr  
Warsaw, Poland  
B.S., University of Alabama, Birmingham, '91

Lee, Christopher W.  
San Jose, CA  
B.A., Harvard University, '90

Malecki-Rogers, Amy  
New Ulm, MN  
B.A., Harvard University, '91

Miller, David Thomas  
Lexington, KY  
B.S., University of Kentucky, '91

Miller, Timothy Matthew  
St. Louis, MO  
B.S., University of Virginia, '91

Pruett, John Robert  
Haverford, PA  
B.A., Princeton University, '90

Rodig, Scott Jefferson  
Crozet, VA  
B.A., University of Virginia, '90

Sedlak, Thomas William  
Cherry Hill, NJ  
B.A., Case Western Reserve University, '91

Shindler, Kenneth Scott  
Greenlawn, NY  
B.S., Brown University, '91

Starks, Charles Greylon  
Tucson, AZ  
B.S., University of Arizona, '89

Wolf, Matthew Joseph  
Dunwoody, GA  
B.A., Washington University, '90

Ying, Howard Shann-Cherng  
Tampa, FL  
B.S., The Johns Hopkins University, '89
Steinman, Peter Alan
Berea, OH
B.S., Duke University, '91

Truong, Rosalie Minh
Los Angeles, CA
B.S., University of California, Davis, '90

DOCTOR OF MEDICINE AND MASTER OF ARTS DEGREES

Graduating Class—May 15, 1992

Blatt, Andrew Nathaniel
St. Louis, MO
A.B., Duke University, '87
Transitional
Emory University
School of Medicine
Atlanta, GA

Hakala, Brian Everest
Pittsburgh, PA
A.B., Harvard University, '86
Orthopedic Surgery
University of Virginia
Charlottesville, VA

Heiss, Steven Gregory
Chicago, IL
B.S.E., The Johns Hopkins University, '87
Transitional
St. John's Mercy Medical Center
St. Louis, MO

Mandal, Robert Walter
Saratoga, CA
B.S., University of California, Davis, '87
Internal Medicine
University of Minnesota
Hospital and Clinic
Minneapolis, MN

Ojennann, Jeffrey George
Seattle, WA
A.B., Princeton University, '87
Surgery-Preliminary
Barnes Hospital
St. Louis, MO

Trainees 1991-92

Fischbach, Peter S.
St. Louis, MO
B.A., Colgate University, '87

Foltz, Gregory Dean
Rochester, IL
B.A., Washington University, '90

Guillerman, Robert Paul
Waverly, KY
B.A., Transylvania University, '89

Hug, Bruce Allen
Tinley Park, IL
B.S., University of Illinois, '88

Nichol, Peter Froso
Madison, WI
B.S., Macalester College, '89

DOCTOR OF MEDICINE DEGREE

Graduating Class—May 15, 1992

Aft-Kenigsberg, Rebecca Linda
Chesterfield, MO
B.S., University of Wisconsin, Madison, '78; Ph.D., '83
General Surgery
Barnes Hospital
St. Louis, MO

Antell, Andrew G.
Westport, CT
B.S., Tufts University, '86
Transitional
Chestnut Hill Hospital
Philadelphia, PA

Arcangeli, Carlos G.
Santa Monica, CA
B.S., University of California, Los Angeles, '88
Surgery - Preliminary
Barnes Hospital
St. Louis, MO

Bacharier, Leonard B.
Massapequa, NY
B.A., The Johns Hopkins University, '88
Pediatrics
St. Louis Children's Hospital
St. Louis, MO

Baranski, Karen Jane
Rockford, IL
A.B., Washington University, '89
Medicine - Preliminary
California Pacific Medical Center
San Francisco, CA

Beck, Brenda Charlotte
San Diego, CA
B.A., University of California, San Diego, '87
Internal Medicine
St. Joseph's Hospital & Medical Center
Phoenix, AZ

Bennett, Norman E.
Penfield, NY
B.S., Cornell University, '87
Internal Medicine
Strong Memorial Hospital
Rochester, NY

Bernstein, Marc J.
Fayetteville, NY
B.A., Haverford College, '88
Obstetrics-Gynecology
University Health Center
Pittsburgh, PA

Bradshaw, Barton G.
Orem, UT
B.A., Harvard University, '87
General Surgery
Virginia Mason Hospital
Seattle, WA

Bradshaw, Joyce G.
Menlo Park, CA
B.A., Harvard University, '86

Brenner, Bruce M.
Passaic, NJ
B.S., New Jersey Institute of Technology, '88
General Surgery
UMDNJ - New Jersey Medical School
Newark, NJ

Brown, Angela L.
Sherrill, AR
B.S., Southern Methodist University, '87
Internal Medicine
Jewish Hospital
St. Louis, MO

Brown, Christopher A.
Fairfield, IL
B.S., University of Illinois, '88
Orthopedic Surgery
Barnes Hospital
St. Louis, MO
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Hultsch, Anne-Lise Avery  
Columbia, MO  
B.A., Washington University, '87  
Medicine - Preliminary  
Jewish Hospital  
St. Louis, MO  

Innat, Daniel M.  
Neshaniz, NJ  
B.A., Rutgers University, '86  
General Surgery  
Wilford Hall USAF Medical Center  
San Antonio, TX  

Ingels, Stephen C.  
Norman, OK  
B.A., Rice University, '83;  
M.S., University of Wisconsin, Madison, '87  
Pathology  
Barnes Hospital  
St. Louis, MO  

Jacob, Dominique  
Kansas City, MO  
B.A., Northwestern University, '88  
Obstetrics-Gynecology  
Cook County Hospital  
Chicago, IL  

Johnson, Byron W.  
Memphis, TN  
B.S., Rhodes College, '88  
Medicine - Preliminary  
University of Tennessee  
Memphis, TN  

Jones, Stephanie Brickner  
Poughkeepsie, NY  
B.S., Cornell University, '88  
Medicine - Preliminary  
Jewish Hospital  
St. Louis, MO  

Kasemnap, Pachavit  
Las Cruces, NM  
B.S., New Mexico State University, '88  
General Surgery  
Wilford Hall USAF Medical Center  
San Antonio, TX  

Kaufman, Richard M.  
Pittsburgh, PA  
B.S., Duke University, '88  
Internal Medicine  
Barnes Hospital  
St. Louis, MO  

Kolar, Brian J.  
Orange, CA  
B.A., Occidental College, '88  
Pathology  
University of Virginia  
Charlottesville, VA  

Kortebcin, Patrick M.  
Milwaukee, WI  
B.S., University of California, Los Angeles, '85  
Transitional  
McGraw U.S. Naval Hospital  
San Diego, CA  

Kunes, Margaret L.  
Phoenix, AZ  
B.A., University of California, San Diego, '87  
General Surgery  
Good Samaritan Hospital  
Phoenix, AZ  

Kwa, Julie A.  
New City, NY  
B.S., Yale University, '88  
General Surgery  
Baylor University Medical Center  
Dallas, TX  

Lai, James Z.  
Tulsa, OK  
B.S., Southern Methodist University, '88  
Medicine - Preliminary  
Jewish Hospital  
St. Louis, MO  

Lederman, Eric D.  
Pittsford, NY  
B.S., Yale University, '88  
Surgery - Preliminary  
Mt. Sinai Hospital  
New York, NY  

Lee, Jon G.  
Sacramento, CA  
B.A., University of California, Berkeley, '87  
Obstetrics-Gynecology  
University of CA - Davis Medical Center  
Sacramento, CA  

Leibowitz, Matthew  
Northbrook, IL  
A.B., Harvard University, '88  
Internal Medicine  
New England Deaconess Hospital  
Boston, MA  

Leimbach, Mark E.  
Aurora, IL  
B.S., University of Michigan, '88  
Internal Medicine  
Barnes Hospital  
St. Louis, MO  

Liakos, Photine  
DeKalb, IL  
B.S., Washington University, '88  
Orthopedic Surgery  
Barnes Hospital  
St. Louis, MO  

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Temple University Hospital  
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Transitional  
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Stanford Affiliated Hospital  
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Barnard, David Robert
Arcadia, CA
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Bean, Joseph Michael
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B.A., Mercer University, Macon, '89

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Belle, Beverly A.
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Boos, Kathleen Ann
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Bridge, Peter Mark
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Buerger, Daniel Eugene
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Cannon, Douglas Todd
Torrance, CA
B.S., California State University, Long Beach, '87

Carbone, Joseph Michael
Flanders, NJ
B.A., Washington University, '89

Carter, Jr., James Curtis
Little Rock, AR
B.A., Washington University, '89

Champagne, Lynne Michelle
Dallas, TX
B.A., University of Texas, Austin, '89

Chen, Jane
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B.S., University of Illinois, '89

Chough, Leo Y.
Tacoma, WA
B.S., University of Washington, '88

Conner, Blair
Oakdale, CA
B.A., University of California, San Diego, '88

Councilman, David Leon
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Crespin, Jeffrey Stephen
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B.A., Harvard University, '88

Cummings, Paul James
Portland, OR
B.A., Willamette University, '87

Davis, Michael Adam
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Deedy, Matthew Grant
Atlanta, GA
B.S., Yale University, '89

Densmore, Tamara
Atlanta, GA
B.S., Emory University, '88

Donovan, Robin Michelle
Seminole, FL
B.S., University of Miami, '89
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<td>Oklahoma City, OK</td>
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<td>Eppell, Beth Anne</td>
<td>Beachwood, OH</td>
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<td>Palmdale, CA</td>
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<td>Prospect, KY</td>
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<td>Grand Island, NY</td>
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<td>Sacramento, CA</td>
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<td>Fox, Lee Andrew</td>
<td>Manhasset Hills, NY</td>
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<td>Zephyr Cove, NV</td>
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<td>Frentchie, Debra L.</td>
<td>St. Louis, MO</td>
<td>B.A., Washington University, '84; M.S., University of Missouri, St. Louis, '87</td>
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<td>Laurens, IA</td>
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<td>Santa Ana, CA</td>
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<td>Merrick, NY</td>
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<td>Hastings, Maria Beth</td>
<td>Fairfield, IL</td>
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<td>Miami, FL</td>
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<td>Jackson, Stephanie Laurel</td>
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<td>Jaeger, Jennifer Leaf</td>
<td>New York, NY</td>
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<td>Jensen, John Newcomb</td>
<td>St. Louis, MO</td>
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<td>Kasinak, Claudine Marie</td>
<td>Chicago, IL</td>
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<td>Keency, James Allen</td>
<td>Florissant, MO</td>
<td>B.S., U.S. Air Force Academy, '89</td>
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<td>Khan, Shireen Enette</td>
<td>St. Louis, MO</td>
<td>B.A., University of North Carolina, Chapel Hill, '89</td>
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<td>Kim, David D.</td>
<td>Chattanooga, TN</td>
<td>B.A., University of Tennessee, Chattanooga, '89</td>
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<td>Kim, Leonard D.</td>
<td>La Canada, CA</td>
<td>B.A., Pomona College, '89</td>
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<td>Kiser, Julie Diane</td>
<td>Washington, DC</td>
<td>B.S., Stanford University, '84</td>
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<td>Levin, Michael Isaac</td>
<td>Highland Park, IL</td>
<td>B.A., Yale University, '89</td>
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<td>Levine, Naomi Rachelle</td>
<td>Dix Hills, NY</td>
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<td>Lin, James C.</td>
<td>Taipei, Taiwan</td>
<td>B.A., University of California, Berkeley, '87; M.A., '89</td>
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<td>McDonald, Colin Timothy</td>
<td>Rockland, MA</td>
<td>B.A., Washington University, '84</td>
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<td>Macnold, Robert Riordan</td>
<td>St. Louis, MO</td>
<td>B.A., Duke University, '89</td>
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<td>McKinnstry, Scott William</td>
<td>Chesterfield, MO</td>
<td>B.A., Creighton University, '87</td>
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<td>Magee, Kendra Patrice</td>
<td>Memphis, TN</td>
<td>B.S., Saint Louis University, '89</td>
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<td>Mariencheck, William L., Jr.</td>
<td>Chesterfield, MO</td>
<td>B.A., Harvard University, '86</td>
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<td>Mason, John Edward</td>
<td>Palos Verdes, CA</td>
<td>B.A., University of California, Santa Barbara, '89</td>
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<td>Miller, David Michael</td>
<td>Farmington Hills, MI</td>
<td>B.S., University of Michigan, '88</td>
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<td>Misir, Nahrayshwar D.</td>
<td>Pasadena, TX</td>
<td>B.S., University of Houston, '88</td>
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<td>Moon, Christopher James</td>
<td>Denver, CO</td>
<td>B.A., Ripon College, '89</td>
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<td>Mueller, Jeff Travis</td>
<td>Salina, KS</td>
<td>B.S., University of Kansas, '86</td>
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<td>Mutone, Martina Francesca</td>
<td>Pittsburgh, PA</td>
<td>B.S., Notre Dame University, '88</td>
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<td>Myles, Seth Adam</td>
<td>St. Louis, MO</td>
<td>B.S., Washington University, '89</td>
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<td>Neil, John Ellis</td>
<td>Hays, KS</td>
<td>B.A., University of Kansas, '89</td>
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<td>Nene, Shriram Madhav</td>
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<td>Nunge, Mark Richard</td>
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<td>B.A., University of Rochester, '89</td>
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<td>Paranjothi, Dr. Parmanthi</td>
<td>Parsons, KS</td>
<td>B.A., University of Kansas, '89</td>
</tr>
</tbody>
</table>
Ahluwalia, Arlina
Oak Brook, IL
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Akins, Victoria Fite
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B.A., Wake Forest University, '80; Ph.D., University of Tennessee, Memphis, '89

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<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>School</th>
<th>Degree, Major</th>
<th>Year</th>
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<tr>
<td>Cragen, Richard Darin</td>
<td>Silex, MO</td>
<td>Central Methodist College</td>
<td>B.A., '90</td>
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<tr>
<td>Daly, Thomas Matthew</td>
<td>Doylestown, OH</td>
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<td>Damore, Steve Joseph</td>
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<td>B.A., '89</td>
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<td>Devine, Thomas Darren</td>
<td>Chesterton, IN</td>
<td>The Johns Hopkins University</td>
<td>B.A., '90</td>
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<td>Dodge, Stephen Michael</td>
<td>Spokane, WA</td>
<td>Pepperdine University</td>
<td>B.S., '90</td>
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<td>Dudek, Steven Michael</td>
<td>Joliet, IL</td>
<td>The Johns Hopkins University</td>
<td>B.A., '90</td>
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<td>Farwell, Donald Gregory</td>
<td>Republic, MO</td>
<td>Drury College</td>
<td>B.A., '90</td>
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<td>Friesen, Darrin Scott</td>
<td>Newton, KS</td>
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<td>B.A., '89</td>
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<td>Garstang, Susan Veronica</td>
<td>Boulder, CO</td>
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<td>Peoria, IL</td>
<td>University of Illinois</td>
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<td>Cedar Rapids, IA</td>
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<td>Yorktown, IN</td>
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<td>Hakakha, Benjamin Asher</td>
<td>Calabasas, CA</td>
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<td>Hamzei, Ali Reza</td>
<td>Tehran, Iran</td>
<td>Purdue University</td>
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<td>Naperville, IL</td>
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**First-Year Class 1991-92**

- Aluja, Ajay  
  Indianapolis, IN  
  B.S., Duke University, '91
- Amin, Avinash  
  Creve Coeur, MO  
  B.A., Washington University, '91
- Baghadady, Rose  
  Weston, MA  
  B.A., Wellesley College, '90
- Bauer, Gregory  
  North Canton, OH  
  B.A., Washington University, '91
- Bautista, Jocelyn  
  Long Grove, IL  
  B.S., University of Illinois, '91
- Belz, Mark  
  Pittsburgh, PA  
  B.S., University of Pittsburgh, '91
- Blam, Michael  
  Port Washington, NY  
  B.S., SUNY at Binghamton, '91
- Board, Mary Ruth  
  Carpenterville, IL  
  B.A., Miami University, '91
- Brown, David J.  
  Anaheim, CA  
  B.A., Claremont  
  McKenna College, '91
- Buckner, Alyson  
  Knoxville, TN  
  B.S., University of Tennessee, Knoxville, '91
- Burrows, Stephen Leon  
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  B.S., Oklahoma State University, '91
- Caccamo, David J.  
  Kansas City, MO  
  B.A., Washington University, '91
- Chambers, Bobbie Joy  
  Richardson, TX  
  B.A., University of Kansas, '91
- Couchman, Jeffrey  
  Springfield, VA  
  B.S., University of Michigan, '90
- Day, Caroline  
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- Delcruznewlan, Francisco  
  Peoria, IL  
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- Dickson, Jamesina  
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- Ellman, Carol  
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- Erlanger, Lisa  
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- Faulkner, Dina  
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- Gehlbach, Brian  
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