

Opportunities

Research and Training Programs for 2013-2014
NIAID Division of Intramural Research



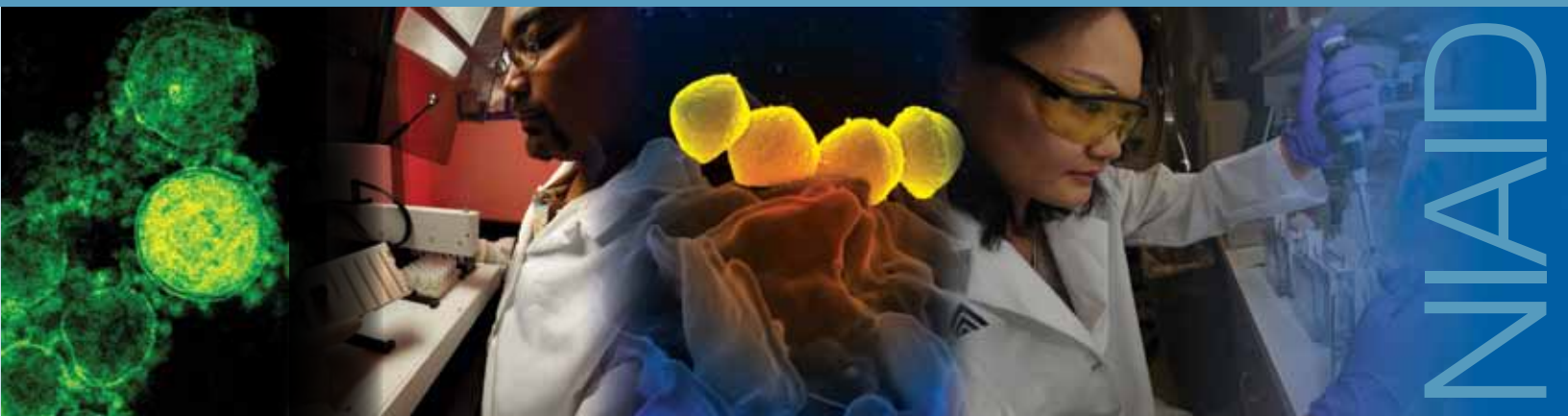
National Institute of Allergy and Infectious Diseases



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

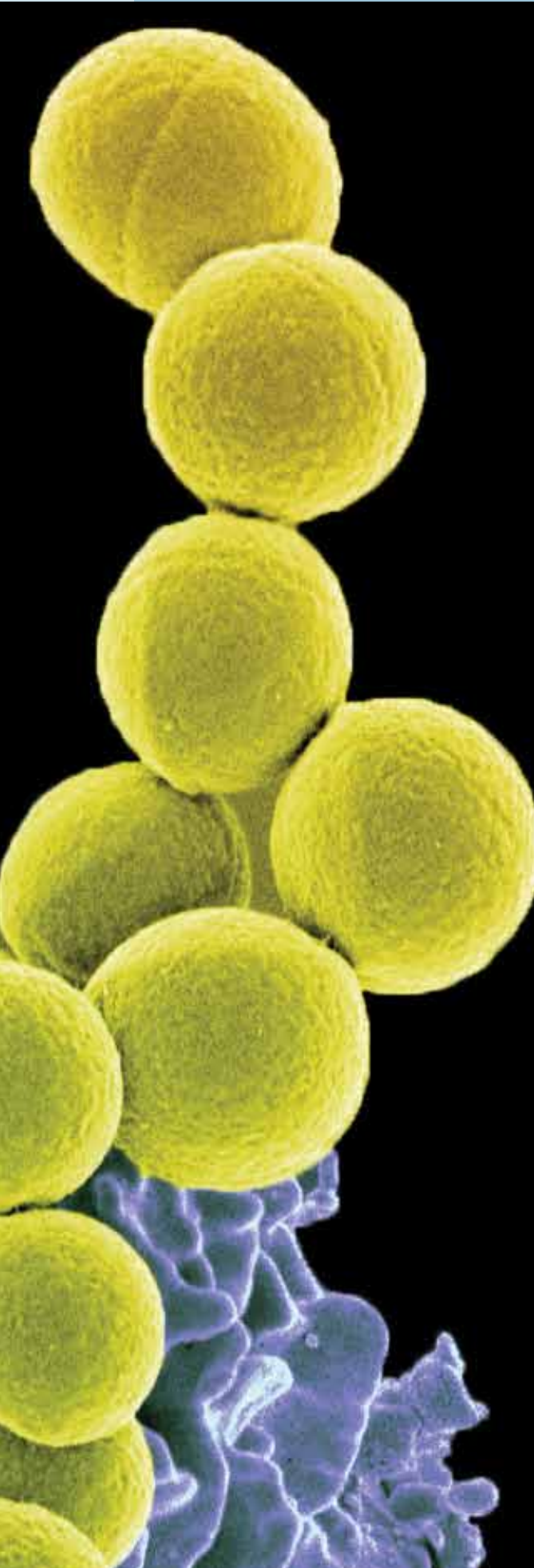
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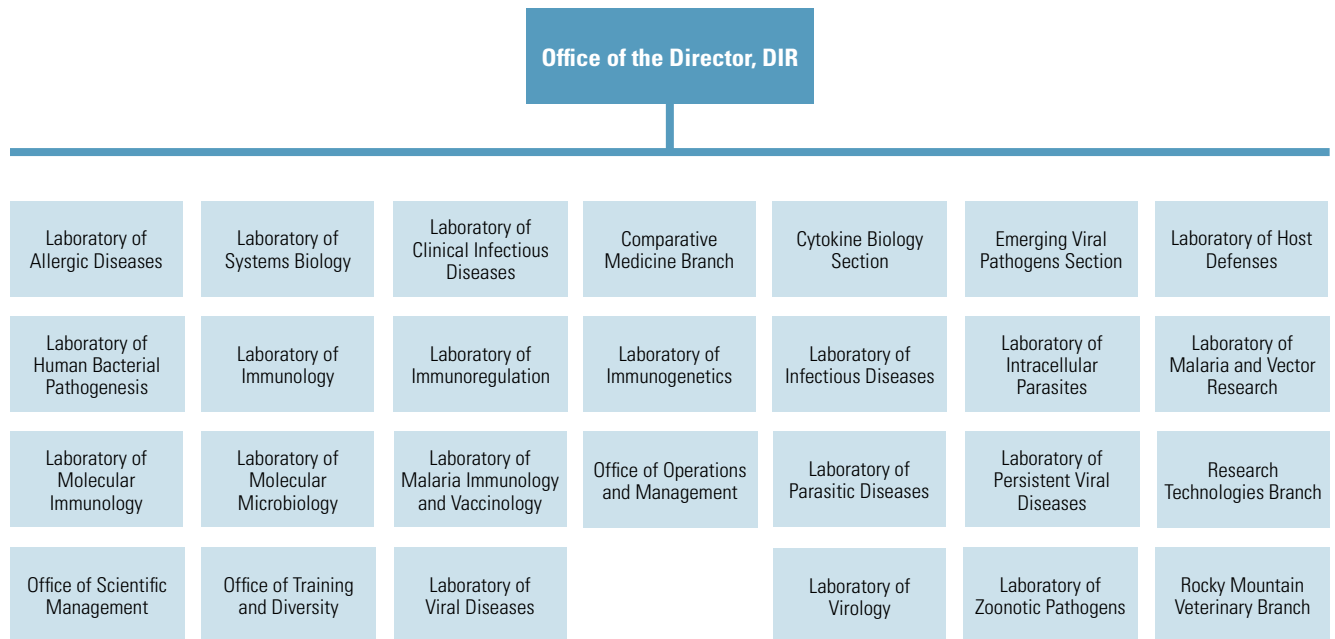
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NIAID Division of Intramural Research Organizational Chart



Introduction

Training the Next Generation of Scientists

Greetings from the Division of Intramural Research (DIR) at the National Institute of Allergy and Infectious Diseases (NIAID). For more than 60 years, DIR has brought together exceptional scientists to conduct basic and clinical research in immunology, allergy, and infectious diseases. DIR researchers have discovered new pathogens, deciphered normal immune system function, identified aberrations underlying immunological diseases, and developed FDA-approved vaccines and therapies.

Today, amazing technological advances in imaging, structural biology, and the “-omics” are helping DIR researchers gain a much deeper understanding of the immune system and host-pathogen interactions. As a result, we are on the precipice of game-changing discoveries in several areas and making exciting progress in our mission to develop new and improved diagnostics, drugs, and vaccines.

Training has long been a central theme at DIR, and we continue to seek the best and brightest talent to help us fulfill our mission. We offer a broad spectrum of laboratory and clinical research opportunities for applicants at various stages in their careers. Our programs include summer internships, postbaccalaureate and postdoctoral training experiences, and accredited medical fellowships in allergy and immunology and in infectious diseases.

The training environment in DIR is rich with opportunities to work side-by-side with renowned scientists and with colleagues from every part of the world. DIR investigators are leaders in their fields and recognized by several prestigious awards. Our international programs offer trainees the chance to gain invaluable field experience in settings where malaria, tuberculosis, and tropical diseases are endemic.

DIR trainees have access to outstanding research facilities, including high-containment laboratories; advanced instrumentation; a robust animal program; and the NIH Clinical Center, the world's largest hospital devoted exclusively to clinical investigation.

But what really sets DIR apart is our focus on the individual trainee. We invest in your career development through mentored research experiences, skill-building workshops, grant-writing seminars, special interest groups, scientific lectures, and individual counseling. Our goal is to make you highly competitive for tenure-track positions at NIAID and at other top-tier research institutions across the country and around the world.

We hope that you will take the time to learn more about DIR laboratories and investigators and that you will consider our training programs as you plan the next step in your scientific career.



Kathryn C. Zoon, Ph.D.
Director
Division of Intramural
Research, NIAID



Karyl S. Barron, M.D.
Deputy Director
Division of Intramural
Research, NIAID



About DIR

Since its beginnings in 1887, when it was a one-person lab housed in the attic of the Staten Island Marine Hospital in New York, the National Institutes of Health (NIH) has grown to 27 institutes and centers and a budget of more than \$30 billion. The National Institute of Allergy and Infectious Diseases (NIAID) is one of the largest institutes at NIH.

The Division of Intramural Research (DIR) is a major component of NIAID. Our purpose is to make scientific discoveries that promote the development of new vaccines, therapeutics, and diagnostics that improve human health. In pursuit of this goal, DIR's research goals are as follows:

- Expand knowledge of immune-system components and functions.
- Define mechanisms responsible for abnormal immune functions, such as immunodeficiency, allergy, and autoimmunity.
- Understand the biology of infectious agents (viruses, bacteria, fungi, and parasites) and the host response to infection.
- Develop strategies to prevent and treat immunologic, allergic, and infectious diseases.

DIR scientists study all aspects of infectious diseases, including the causative agent, vectors, and pathogenesis in human and animal hosts. Clinical research also is integral to the mission of DIR, allowing key lab discoveries to be translated rapidly into methods of disease prevention, diagnosis, or treatment. DIR researchers are conducting more than 120 clinical trials at the NIH Clinical Center on the Bethesda, Maryland, campus and at collaborating U.S. and international sites.

Unparalleled Opportunities

DIR is home to a vibrant research community of more than 125 principal investigators who lead research groups composed of staff scientists, physicians, fellows, technical personnel, and students. DIR principal investigators are distinguished in their fields, recognized with numerous awards, and include several members of the U.S. National Academy of Sciences and the Institute of Medicine. Trainees, both pre- and postdoctoral physicians and scientists, constitute the largest staff group in DIR.

The atmosphere within DIR is one of collegiality, open exchange of ideas, and collaboration. Exceptional research facilities provide investigators with access to state-of-the-art instrumentation in imaging, proteomics, genomics, structural biology, and cell analysis, as well as animal genetics. Taken together, DIR is a superb scientific setting for research and an unsurpassed training ground for new researchers.



“DIR scientists study all aspects of infectious diseases, including the causative agent, vectors, and pathogenesis in human and animal hosts. Clinical research also is integral to the mission of DIR, allowing key lab discoveries to be translated rapidly into methods of disease prevention, diagnosis, or treatment.”



World-Class Facilities

DIR has 19 laboratories and 2 free-standing sections that conduct peer-reviewed research. It also has several branches that focus on new research technologies and animal care. Most DIR labs are located on the NIH campus in Bethesda, Maryland, and in nearby Rockville, Maryland. Our other Maryland facilities are located in Frederick, nearly 40 miles north of the main NIH campus.

DIR also has a large research campus in Hamilton, Montana, known as the Rocky Mountain Laboratories. The campus features a new building with BSL-2, BSL-3, and BSL-4 laboratory space.

Other research amenities available to DIR employees and trainees include the following:

- The NIH Clinical Center, the world's largest hospital devoted exclusively to clinical investigation
- State-of-the-art technology development facilities for protein chemistry, flow cytometry, confocal microscopy, electron microscopy, genomics, and bioinformatics
- Flow cytometry, cell sorting, and multiphoton confocal microscopy technology in a BSL-3 environment, with trained staff to operate the instrumentation safely
- Small-group and individual training in the use of specialized instrumentation and the development of research applications
- In-house facilities to design, conduct, and analyze results from microarray experiments for all species, including microbial pathogens
- Development and breeding of transgenic and knockout mice
- The Comparative Medicine Branch, which manages all aspects of research involving laboratory animals
- Computer networking and teleconferencing facilities, including satellite linkage to DIR-supported facilities at international sites

International Research

DIR is a leader in global research. Its International Centers for Excellence in Research (ICER) program, launched in 2002, is a model for developing and sustaining research programs in resource-poor countries. Through partnerships with local scientists, NIAID has developed core programs at the ICER sites—currently located in Mali, Uganda, and India—and, over time, has facilitated the expansion of research capacity by training young scientists, improving laboratory and clinical infrastructure, and enhancing information technology capabilities.

The ICER program builds on experience gained from NIAID's long-standing malaria research collaboration with scientists in Mali. Initially, the collaboration focused on the genetics of malaria mosquitoes, but it has expanded significantly over the years. Today, Malian researchers collaborate with NIAID scientists on multiple projects, including studies on mosquito vectors, malaria drug

resistance, and candidate malaria vaccines; research on neglected tropical diseases such as filariasis and leishmaniasis; and, more recently, other vector-borne diseases, including relapsing fever and Lassa fever. In addition to these activities, several extramural researchers supported by NIAID are involved at the Mali ICER in collaborative research and training in malaria, leishmaniasis, and HIV/tuberculosis co-infection.

The ICER site in Uganda, which includes a state-of-the-art field laboratory in the Rakai district and facilities at Makerere University in Kampala and the Uganda Virus Research Institute in Entebbe, conducts basic and clinical research on HIV and other sexually transmitted infections, including studies on viral pathogenesis, transmission kinetics, treatment, and prevention. More recently, NIAID scientists and counterparts at the Uganda ICER initiated collaborative studies on malaria in children and pregnant mothers. The ICER site in India, located at the Tuberculosis Research Centre in Chennai, conducts collaborative studies on filariasis and, more recently, on tuberculosis-filarial and HIV-filarial co-infections.

In addition to its ICER sites, DIR has collaborative research programs under way at several international sites, including the following:

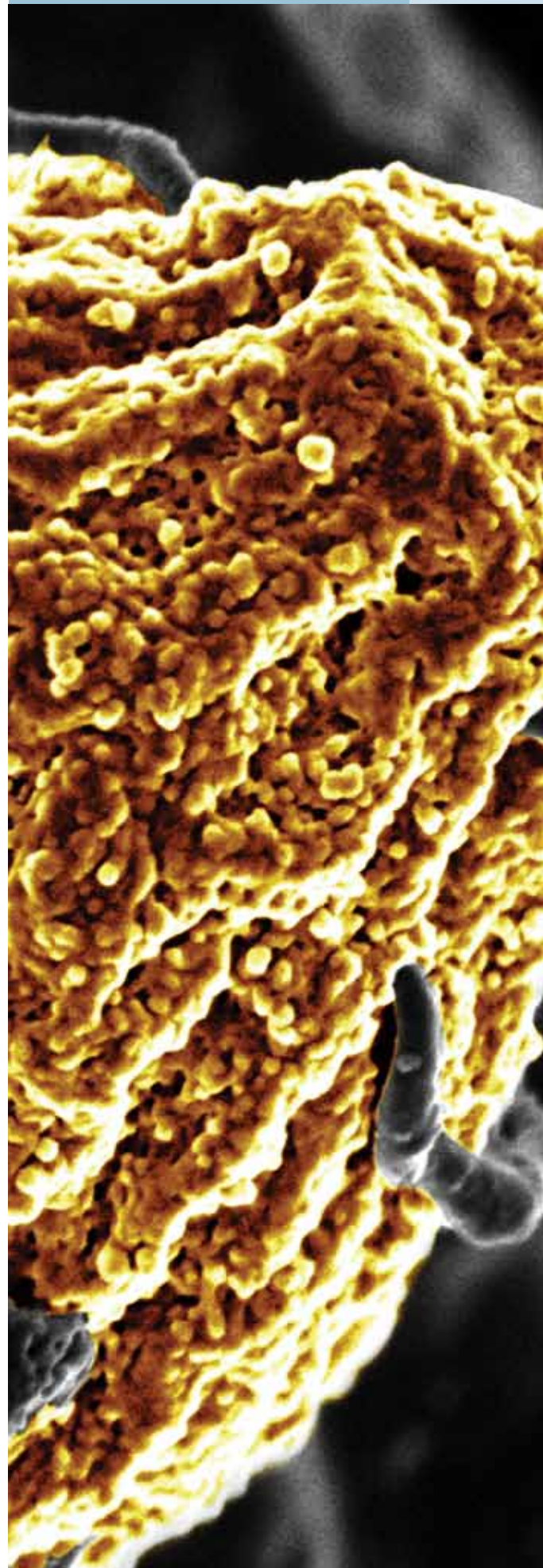
- Brazzaville, Republic of the Congo—filoviruses
- Khon Kaen and Bangkok, Thailand—nontuberculous mycobacteria and immune deficiency
- Lima, Peru—neurocysticercosis
- Masan, Seoul, and Taejon, South Korea—tuberculosis
- Phnom Penh and Pursat, Cambodia—malaria
- Zhengzhou, China—tuberculosis

The Edge of Scientific Discovery

DIR has long been at the forefront of research on immunologic, allergic, and infectious diseases. DIR scientists discovered the Lyme disease bacterium, the Norwalk virus responsible for epidemic gastrointestinal disease, several chemokine receptors, and the cytokine interleukin 4. DIR scientists have developed vaccines for hepatitis A and E and rotavirus, and they are currently conducting clinical studies of more than a dozen vaccine candidates for malaria, dengue, and viral respiratory infections.

DIR laboratory and clinical research on rare immune system diseases led to the discovery of autoimmune lymphoproliferative syndrome and its underlying genetic basis, the discovery of the gene mutation responsible for Job's syndrome, and the development of gene therapies for severe combined immunodeficiency and chronic granulomatous disease.

For more than 25 years, DIR scientists have made important observations about the pathogenesis of HIV/AIDS, including the recent identification of another cellular receptor for HIV. DIR researchers also have made great strides in the development of therapies for drug-susceptible and drug-resistant tuberculosis, with promising treatments currently in advanced clinical trials.



DIR Training Programs

NIAID offers several training opportunities, including Summer Internship Programs in Biomedical Research, postbaccalaureate and postdoctoral programs, and medical rotations and fellowships.



Wendy J. Fibison, Ph.D.
Associate Director
Office of Training and Diversity

The DIR Office of Training and Diversity (OTD) offers research experiences for scientists at all levels and serves as a focal point for training at NIAID's laboratories in Maryland and in Hamilton, Montana.

Mentored research opportunities range from postdoctoral and clinical research fellowships to graduate partnership programs and postbaccalaureate traineeships.

NIAID research trainees participate in OTD's numerous career development activities, such as an annual fellows retreat, skill-building workshops, and grant-writing seminars. OTD also emphasizes mentoring and individual career counseling, as well as conflict resolution to ensure a robust and competitive research program.

OTD is committed to increasing the participation at NIAID of populations underrepresented in biomedical research through two primary programs. An annual outreach program, Intramural NIAID Research Opportunities (INRO), seeks talented undergraduate and doctoral students interested in NIAID's research and training programs. The OTD Sponsorship Program supports underrepresented scientists through individual mentorship, a special seminar series, and other events to ensure inclusion and diversity at NIAID.

Quick Reference

DIR Office of Training and Diversity

Wendy J. Fibison, Ph.D.,
Associate Director
Quarters 15 F1
6 North Court, MSC 2663
Bethesda, MD 20892-1350
wfbison@niaid.nih.gov
www.niaid.nih.gov/about/organization/
dir/Pages/otd.aspx

INRO Program

www.niaid.nih.gov/labs/training/inro

Applications are open from August 15 to
October 15.

Postdoctoral Training

DIR has several options for those interested in postdoctoral laboratory research training. Our programs consist of a minimum of two to three years of research in one of the DIR labs, and Ph.D. and M.D. candidates can apply.

Available appointments differ slightly in their requirements for citizenship and postdoctoral experience, but all have the same starting point: finding the best research fit for you. Start by reading the descriptions of the labs and investigators in this book and determining which lab or investigator is conducting research in your area of interest.

Appointment Mechanisms

If you are selected for an NIAID DIR postdoctoral program, you may be appointed under one of several mechanisms, depending on the availability of funding, type of research, and your qualifications. These appointment mechanisms include the following:

- **Postdoctoral Fellowship, including the NIH Intramural Research Training Award (IRTA)**, requires that you be a U.S. citizen or permanent resident with a doctoral degree and five or fewer years of postdoctoral experience.
- **Research Fellowship** is for highly experienced postdoctoral scientists (generally more than five years of postdoctoral experience) who seek further research training and professional development.
- **NIH Visiting Program (VP)** offers scientists who are not U.S. citizens the opportunity to receive further training or to conduct research in their specialties. Appointments include the **Postdoctoral Fellowship (VP)**, which requires that you have a doctoral degree and five or fewer years of relevant postdoctoral experience.

Other Appointments

- **Adjunct Investigator** appointment is possible if you have outside funding and want to enhance your research capabilities in a DIR laboratory. U.S. citizenship is not required.
- **Special Volunteer** appointment is suitable if you have funding from a foundation or private grant and wish to conduct research in an NIAID lab.
- **Guest Researcher** appointment allows you to use NIH facilities, equipment, and resources for your research and training; however, you cannot provide services to NIH.

NIAID Malaria Infection Biology Research and Training Program

The NIAID Malaria Infection Biology Research and Training Program seeks young scientists finishing their Ph.D. in immunology, parasitology, or closely related fields to study the interface of malaria and the host immune response. Graduate students also are encouraged to consider this program for their thesis work.

How to Apply

Postdoctoral Opportunities

Visit www.training.nih.gov/career_services/postdoc_jobs_nih, search “NIAID,” and complete an online application for the program that interests you.

OR

After reading this book, send the following information to the NIAID lab chief or investigator with whom you are interested in working:

- A cover letter describing your background, research interests, career goals, and the special training or experience you are seeking. Include the date you can begin training, home address, home and office telephone numbers, fax number, and email address.
- A copy of your curriculum vitae and bibliography. Representative publications are welcome.

If you would like your application to be distributed to more than one lab, send this information to the following contact:

Wendy J. Fibison, Ph.D.,
Associate Director
Office of Training and Diversity
Quarters 15 F1, 6 North Court, MSC 2663
Bethesda, MD 20892-1350
wfibison@niaid.nih.gov

Malaria Infection Biology Research and Training Program

Visit www.niaid.nih.gov/labs/training/mib_program for a full description of the program. Submit a curriculum vitae; a short description of your thesis research and interest in malaria infection biology; and two letters of recommendation, one from your thesis advisor, to the following contact:

Susan K. Pierce, Ph.D., Director
NIAID Malaria Infection Biology Research and Training Program
spierce@nih.gov

How to Apply

Learn more about predoctoral training programs by visiting the following websites:

- **Postbaccalaureate IRTA**
www.training.nih.gov/programs/postbac_irta
- **Graduate Partnerships Program**
www.training.nih.gov/programs/gpp
- **NIH-Oxford-Cambridge Scholarship Program**
oxcam.gpp.nih.gov
- **Technical IRTA**
www.training.nih.gov/programs/tech_irta
- **Summer Internships**
www.training.nih.gov/programs/sip

Complete an online application for the program in which you are interested.

OR

After reading this book, send the following information to the NIAID lab chief or investigator with whom you are interested in working:

- A cover letter describing your background, research interests, career goals, and the special training or experience you are seeking. Include the date you can begin training, home address, home and office telephone numbers, fax number, and email address.
- A copy of your curriculum vitae and bibliography. Representative publications are welcome.

If you would like your application to be distributed to more than one lab, send this information to the following contact:

- Wendy J. Fibison, Ph.D.,
Associate Director
Office of Training and Diversity
Quarters 15 F1, 6 North Court, MSC 2663
Bethesda, MD 20892-1350
wfibison@niaid.nih.gov

Predocutorial Training for Students

- **Postbaccalaureate Intramural Research Training Award (IRTA)** provides the opportunity to postpone your application to graduate or medical school so you can get an introduction to biomedical research. To qualify, you must be a U.S. citizen, have graduated from a fully accredited U.S. college or university, and have held the degree for no more than two years. Also, you must intend to apply to graduate or medical school in biomedical research during your time at NIAID.
- **Graduate Partnerships Program** links NIH to national and international universities in the training of graduate students. You have the academic environment of a university and the breadth and depth of research at NIH. This includes the **NIH-Oxford-Cambridge Scholars Program**, an accelerated, international doctoral program in partnership with the Universities of Oxford and Cambridge in the United Kingdom. It is open to exceptional students in the field of biomedical research. Students admitted to the program typically design an innovative Ph.D. project, with co-mentorship by at least one NIH and one university principal investigator.
- **Technical IRTA** is for applicants with a bachelor's or master's degree in a biomedical research field. It is a two-year program designed to help you develop the advanced skills and techniques necessary to be a highly trained research support professional.
- **Summer Internships** in an NIAID laboratory can enhance your knowledge and understanding of the world of biomedical research and help you plan your academic goals. DIR offers 10- to 12-week summer internships for high school, college, graduate, and medical students. An online application for the following summer is available in early November. The application deadline is March 1.

Clinical Training Opportunities

NIAID offers three-year ACGME-approved fellowship programs in infectious diseases and in allergy and immunology. These programs aim to develop clinical and basic research skills in physicians who are well-grounded in clinical medicine and are pursuing a career in biomedical research.

Before beginning a fellowship, applicants must have completed three years of residency training in an approved internal medicine program (or in pediatrics for the allergy and immunology training program) in the United States or Canada. Qualified individuals may apply for a student loan repayment program that currently repays up to \$35,000 per year of eligible student debt.

The three-year NIAID programs consist of one year of clinical responsibilities and two years in research. All trainees spend up to six months of the first year caring for patients at the NIH Clinical Center. All NIAID patients participate in research protocols conducted by DIR investigators.

Patients enter the Clinical Center with various diseases, including the following:

- Autoimmune diseases
- Genetic and acquired immunodeficiencies
- Disorders of neutrophil and monocyte function
- Severe, acute, and chronic viral infections, including herpes simplex, Epstein-Barr virus, and HIV
- Eosinophilic gastrointestinal diseases
- Hypereosinophilic syndromes
- Allergic diseases, including asthma, anaphylaxis, and mast cell disorders
- Parasitic diseases
- Mycoses

During the remainder of clinical training, fellows join traditional consultation services and didactic rotations at NIH and other medical institutions in the surrounding area. Following clinical training, fellows conduct research in any one of the intramural laboratories at NIAID or in other NIH laboratories or programs.



How to Apply

Applicants to the allergy and immunology and infectious diseases training programs should follow the instructions in ERAS at www.aamc.org/students/eras/start.htm.

In addition to what is included in the application package, DIR requests the following:

- A personal statement describing the program to which you wish to apply, your background, your research interests, your career goals, and the special training or experience you are seeking at NIH
- Copies of your medical school/graduate school transcripts

Allergy and Immunology Training Program

Candidates should apply for the program 12 months prior to entry in July. The application deadline in ERAS is September 15. Applicants must be on track to complete an ACGME-approved residency in internal medicine or pediatrics at the time they enter the program. Interviews are held between November and April.

Kelly D. Stone, M.D., Ph.D., Director
Allergy and Immunology Training Program
10 Center Drive, MSC 1899,
Room 12C103
Bethesda, MD 20892-1899
301-435-0993
301-480-5757 (fax)
stonek@niaid.nih.gov

Infectious Diseases Training Program

Applications are accepted only via ERAS. The program participates in the National Resident Matching Program. Interviews are held from September to October prior to the match. Programs and applicants to the match submit final selections in the fall of the year prior to the start date of the fellowship.

Ericka Thomas, Program Coordinator
Infectious Diseases Training Program
10 Center Drive, MSC 1899,
Room 12C103
Bethesda, MD 20892
301-496-3461
301-402-0050 (fax)
thomaser@niaid.nih.gov

Allergy and Immunology Training Program

The Allergy and Immunology Training Program is designed to train fellows in the care of children and adults with immunologic diseases, including allergy, immunodeficiency, and autoimmune diseases. Fellows have a well-rounded clinical experience in their first year of training and subsequently develop a research program to advance the care of these patients.

The program accepts applications from residents in internal medicine or pediatrics who have completed training in the United States or Canada and who are not J-1 visa holders. H-1 visa holders may apply. Applications for the program are made through the Electronic Residency Application System (ERAS), and the program participates in the National Resident Matching Program.

Trainees who wish to become board-eligible in allergy and immunology are required to do the following:

- Complete inpatient and outpatient rotations at the NIH Clinical Center, Walter Reed National Military Medical Center, the Johns Hopkins Hospital, and Children's National Medical Center during their first year of training.
- Participate in monthly continuity clinics during their second year of training.
- Provide allergy and immunology consultation to the NIH Clinical Center.
- Attend the core basic and clinical immunology conferences and case conferences of the training program.
- Attend monthly journal clubs.
- Take American Board of Allergy and Immunology certification preparatory courses.

Infectious Diseases Training Program

The Infectious Diseases Training Program accepts applications from residents in internal medicine who have completed training in the United States or Canada and who are not J-1 visa holders. H-1 visa holders may apply.

Three years of residency training are required. Applicants who wish to pursue the ABIM Research Pathway, and who have the approval of the director of their respective internal medicine residency program, may apply for a fellowship to begin after two years of residency. Applicants accepted under the ABIM Research Pathway must spend four years in fellowship to be eligible for certification in both internal medicine and infectious diseases.

The first year of the training program is entirely clinical and comprises 11 months of rotations at NIH and five outside sites. In addition to the NIH Clinical Center, fellows rotate at Johns

Hopkins Hospital, George Washington University Medical Center, Georgetown University Medical Center, and Washington Hospital Center. Fellows also rotate on the NIAID Inpatient Ward and spend two to three weeks at a private-practice infectious diseases clinic. Fellows receive formal and informal training in hospital epidemiology and diagnostic microbiology.

Fellows are required to attend a weekly continuity clinic and participate in teaching conferences during the first two years of the training program. Fellows take the IDSA Infectious Diseases In-Training Examination during their first and second years and are eligible to take the Infectious Diseases Board Examination in their third year (fourth year for ABIM Research Pathway fellows).

NIAID Transition Program in Clinical Research

The NIAID Transition Program in Clinical Research provides opportunities for physicians to gain clinical and translational research experience in association with a DIR laboratory. NIAID conducts a national search to identify participants for this program. Participants are appointed as assistant clinical investigators. Applicants must have an M.D. or an M.D./Ph.D., be board-eligible or board-certified in a subspecialty (or equivalent), and qualify for credentialing from the NIH Clinical Center.

Candidates may choose the laboratory in which they will carry out their program, contingent upon approval from the lab chief and the DIR Director. Appointments are for three to five years; accepted participants will be reviewed throughout their appointments by a committee composed of DIR senior investigators with clinical research interests. Participants also will be paired with a senior clinical investigator who will serve as a mentor.

The application package must include a curriculum vitae/ bibliography, three letters of reference sent directly from the referee to NIAID, a two-page research proposal, and a letter of support from the accepting NIAID lab chief. Submit application materials to the following address: NIAIDDIRSearch@niaid.nih.gov.

For questions about the program, contact Karyl S. Barron, M.D., at kbarron@niaid.nih.gov.

Competitive candidates will be asked to present their research accomplishments and plans to the search committee. Visit www.niaid.nih.gov/about/organization/dir/pages/clinicalresearchtransition.aspx for more information.

Selection Process

Candidates are selected for interviews on the basis of their clinical and/or research credentials and research interests. Interview visits to the NIH campus are designed to introduce potential trainees to NIH preceptors and to provide the candidates with the opportunity to explore the nature of the research they might conduct. A selected candidate is offered a position that may be based on a number of funding mechanisms, depending on availability of funding, the type of research to be conducted, and the qualifications of the candidate.



“ Fellows accepted into the infectious diseases or allergy and immunology training program and who have substantial student loans are eligible to apply for loan repayment. ”

Loan Repayment Programs

Fellows accepted into the infectious diseases or allergy and immunology training program and who have substantial student loans are eligible to apply for loan repayment. There are competitive and noncompetitive repayment programs.

General Research Loan Repayment Program

The NIH General Research Loan Repayment Program (General LRP), authorized by Congress in 1993, was established to attract highly qualified professionals, particularly physicians, to conduct research at NIH. Unlike previously authorized LRPs that targeted specific areas or types of research, such as AIDS or clinical research, this program supports research in a variety of scientific disciplines.

The General LRP may repay up to a maximum of \$35,000 per year toward participants' outstanding eligible education loans. In return, participants must sign a contract agreeing to conduct qualified research activities as NIH employees for a minimum of three years. Continuation contracts for additional years may be entered.

In addition, fellows employed by NIH in subspecialty and residency training programs accredited by ACGME are eligible for \$17,000 in loan repayment plus tax reimbursement.

AIDS Research Loan Repayment Program

AIDS research at NIAID encompasses work on the etiological agent, pathogenesis, therapeutics, vaccine development, cofactors predisposing to HIV infection and AIDS, and epidemiology and natural history of HIV infection. AIDS research will continue to require dedicated, well-trained basic and clinical scientists. This loan repayment program was instituted to permit qualified postdoctoral physicians and scientists to enter this area of research. In exchange for loan repayment benefits, researchers must agree to participate in AIDS research for a minimum of two years. Continuation contracts for additional years may be entered.

Clinical Research Loan Repayment Program for Individuals from Disadvantaged Backgrounds

The NIH Clinical Research Loan Repayment Program (CR-LRP) is designed to recruit highly qualified health professionals from disadvantaged backgrounds to serve as clinical researchers. Eligibility requirements for the CR-LRP are the same as those for the other LRPs, with two additional criteria: 1) You must be from a disadvantaged background, and 2) You must be awarded clinical privileges by the Clinical Center Medical Board or other credentialing board upon NIH employment.

An individual from a disadvantaged background is defined as one who comes from a family with an income below low-income thresholds or from an environment that inhibited (but did not prevent) him or her from obtaining the knowledge, skill, and ability required to enroll in and graduate from a health professions school. The income level considers family size and Bureau of the Census statistics, with annual adjustments for changes in the Consumer Price Index. The Department of Health and Human Services adjusts this level for use in all health professions programs and publishes this information periodically in the *Federal Register*.

General Requirements for Loan Repayment Programs

- You must be a U.S. citizen, U.S. national, or permanent resident of the United States.
- You must have a health professional doctoral degree (Ph.D., M.D., D.O., D.D.S., D.M.D., Pharm.D., or equivalent doctoral level degree) or a P.A., B.S.N., or A.D.N. degree from an accredited institution.
- You must have qualifying educational debt in excess of 20 percent of your annual NIH base salary on the expected date of program eligibility.



Quick Reference

NIH Loan Repayment Programs

866-849-4047

www.lrp.nih.gov



Tenure and Tenure Track at NIAID

The primary purpose of an NIH fellowship is to provide time-limited research training, clinical training, and/or career development opportunities to postdoctoral scientists. At the end of the training period, the majority of fellows will leave NIH to pursue careers at institutions in the United States or abroad. Longer appointment positions may be available through tenure-track or tenured positions. Opportunities for such appointments arise when research in a specific area is needed to fulfill the NIAID mission.

Tenure at NIAID consists of a permanent position and a long-term commitment of salary, personnel, and the research resources needed to conduct an independent research program within the scope of the NIAID mission. Scientists at NIAID obtain tenure in one of two ways: 1) The scientist is recruited from a national search for a tenured position after compiling an extensive research record at another institution or at NIH, or 2) The scientist successfully competes for and completes a tenure-track appointment at NIAID and is advanced to tenure.

Following nationwide recruitment efforts, candidates for both tenured and tenure-track positions are selected by a search committee and a recommending official and approved by the NIH Deputy Director of Intramural Research. While traditional tenure and tenure-track positions are created by the hiring laboratory, DIR's new Clinical Tenure-Track Program will periodically conduct searches for outstanding clinical researchers. Selected clinical tenure-track candidates are then matched to an NIAID laboratory.

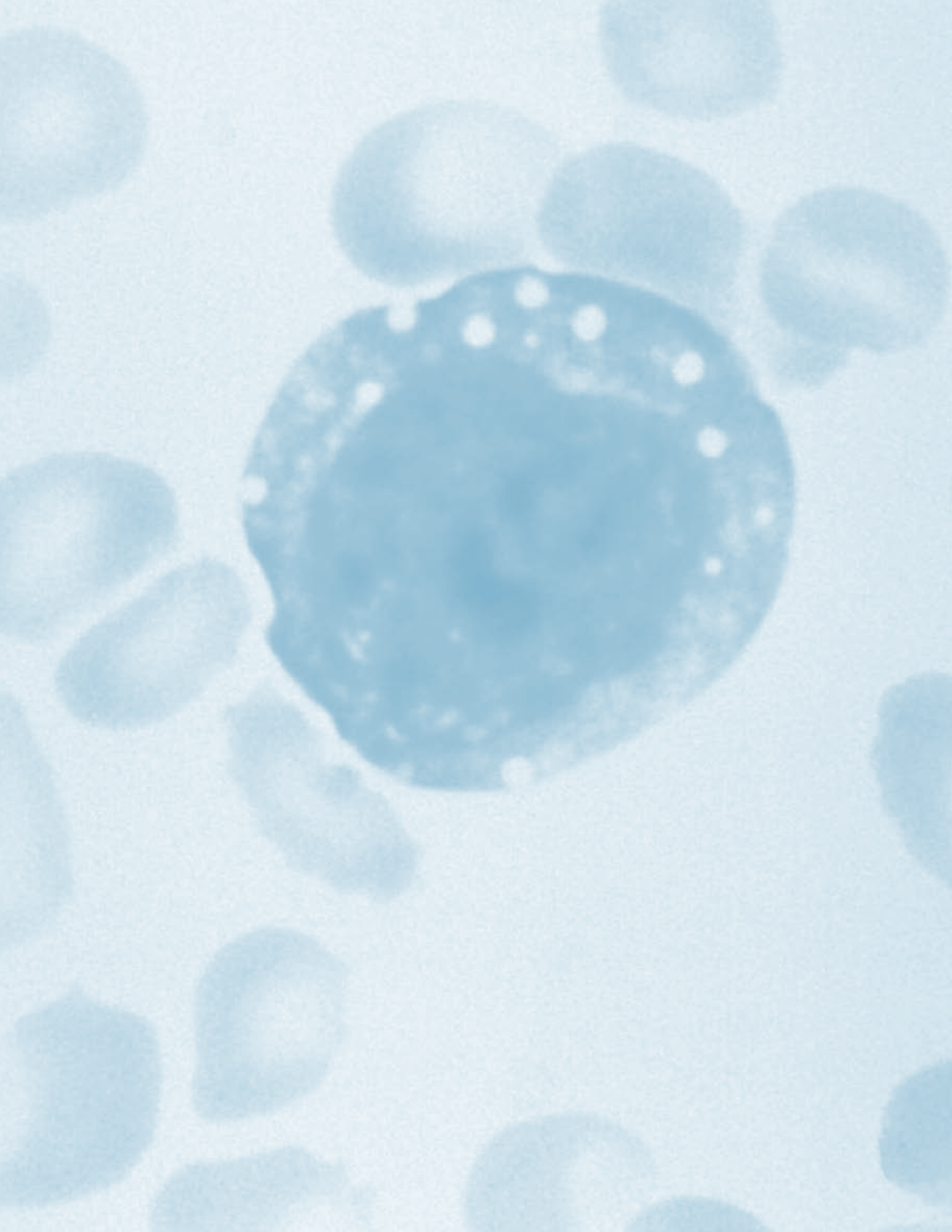
Tenure-track investigators in basic research are given seven years to establish themselves as independent scientists before being evaluated for tenure; clinical tenure-track candidates are given up to nine years. At the midpoint, the NIAID Board of Scientific Counselors (BSC) reviews the candidate's and the lab's performance and qualifications for tenure and decides whether the candidate should continue in tenure track or advance for an accelerated tenure decision. The BSC reviews the candidate's performance again at the completion of the tenure-track period and decides if the candidate should be recommended for tenure.

If a candidate is recommended for tenure by the BSC and the NIAID Promotion and Tenure Committee or by a search committee, and if the DIR Director concurs, the request is forwarded for approval to the NIH Central Tenure Committee, which is chaired by the NIH Deputy Director for Intramural Research.

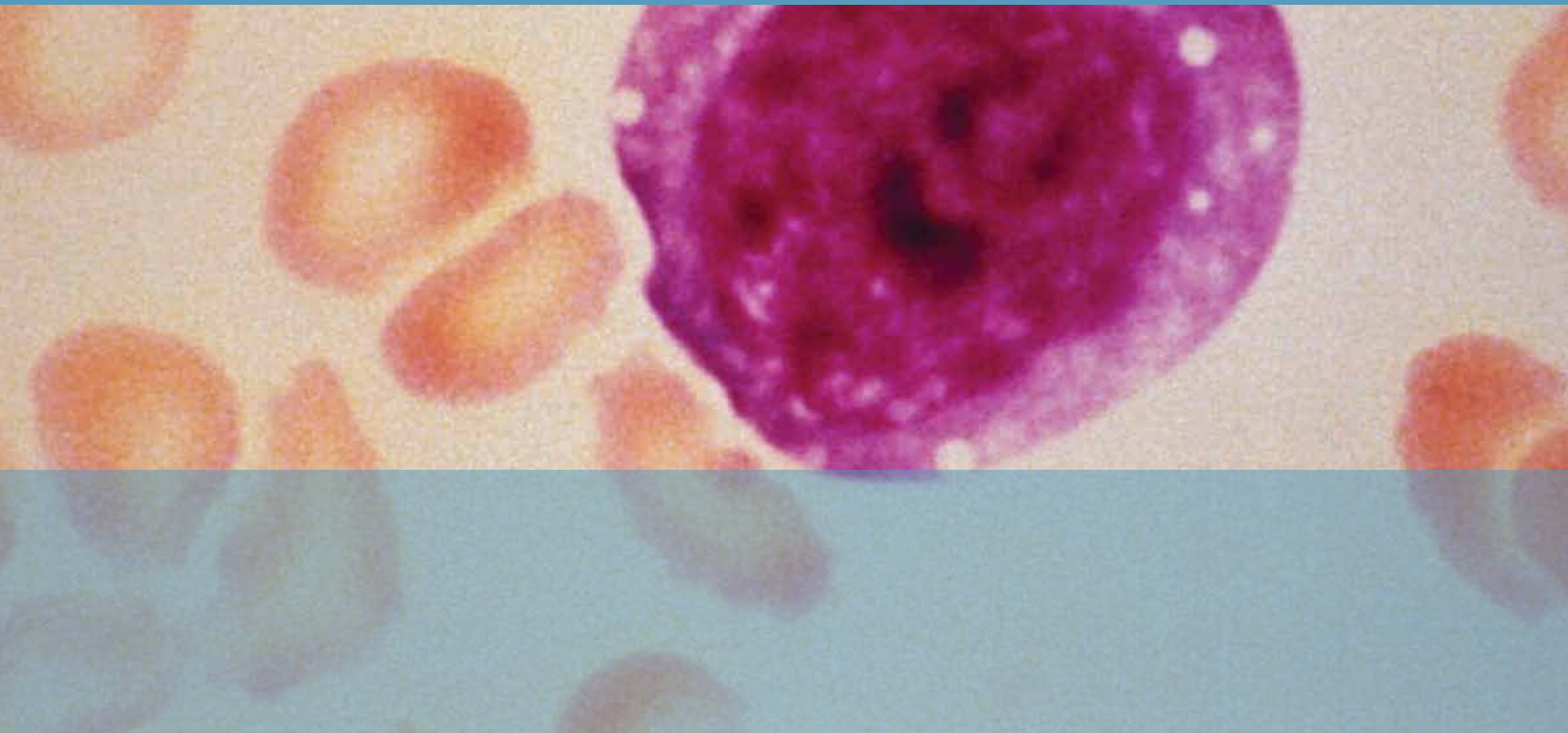
Timeline for Nontenured Staff

The initial fellowship appointment is for a period of two to three years. This may be renewed at the request of the host laboratory, if it is mutually beneficial to do so. It is the usual policy of NIH that postdoctoral trainees should not remain at NIH for more than five years. The overall limitation is eight years, regardless of appointment mechanism, unless the postdoctoral trainee is approved for tenure track or a permanent appointment.





DIR Laboratories and Branches




**Comparative Medicine
Branch**

**Randy Elkins, D.V.M.; Diplomate,
ACLAM; Chief**

www.niaid.nih.gov/labs/aboutlabs/cmb
301-496-0560

Research Support Activities

The Comparative Medicine Branch (CMB) assists NIAID's intramural scientists by ensuring that the animals they use receive high-quality care, thereby limiting the impact of these factors on their research.

The Laboratory Animal Medicine Section and Laboratory Animal Sciences Section provide guidance to the Institute's intramural scientists who use animals in research projects. Support functions include the following:

- Managing containment facilities for infectious disease research performed at animal biosafety levels 1-3
- Assisting with the development, annual review, and renewal of animal study proposals
- Purchasing animals
- Importing and exporting animals to and from locations throughout the world
- Overseeing intramural contracts and inter- and intra-agency agreements involving animals
- Diagnosing, characterizing, and treating diseases
- Controlling adventitious infectious agents
- Selecting and properly administering anesthetics and analgesics
- Overseeing the construction and renovation of animal facilities and assisting with planning for future animal-related requirements
- Tracking animal cage information through an interactive website

CMB's Infectious Disease Pathogenesis Section provides necropsy, histopathology, and analytic pathology support. The section members include a pathologist specializing in infectious diseases and histotechnologists with expertise in immunohistochemistry. In addition to routine support, the section provides digital scanning of stained slides, training in necropsy and sample collection, and assistance in experiment design.

CMB's Assisted Reproduction Technology, Cryopreservation Unit provides embryo rederivation; embryo, sperm, and ovarian cryopreservation; *in vitro* fertilization; and embryo manipulation-microinjection (transgenic production, intracytoplasmic sperm injection, and recombinant embryonic stem cells).

CMB maintains a gnotobiotic animal facility: 12 bio-exclusion units designed to keep mice from becoming colonized with any adventitious microorganisms. Breeding colonies and mice on study are maintained in semi-rigid isolators provided with HEPA-filtered air and autoclaved food, bedding, and supplies. Strict standard operating procedures are followed to maintain the mice in a germ-free state. Projects are approved by a Gnotobiotic Users Committee.



Randy Elkins, D.V.M.; Diplomate, ACLAM

Associate Director for Laboratory Animal Resources, DIR

Director, Animal Program, DIR

Chief, Comparative Medicine Branch

Chief, Infectious Disease Pathogenesis Section, CMB

www.niaid.nih.gov/labs/aboutlabs/cmb

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Dr. Elkins obtained his D.V.M. in 1974 from the University of Missouri, College of Veterinary Medicine. He completed a one-year internship in large animal surgery at the University of California, School of Veterinary Medicine, Veterinary Medical Teaching Hospital. Following several years of clinical practice in California, he completed a residency in comparative pathology at the U.S. Army Medical Research Institute of Infectious Diseases in Frederick, Maryland.

He joined the NIAID Laboratory of Infectious Diseases as a senior staff veterinarian in 1992 and was promoted to head of its Experimental Primate Virology Section in 1997. In 2000, Dr. Elkins was appointed DIR Associate Director for Nonhuman Primate Research and, in 2001, DIR Associate Director for Laboratory Animal Resources and Animal Program Director. He became specialty board-certified by the American College of Laboratory Animal Medicine in 1996.

Major Areas of Research

- Biostability of research models and issues related to animal welfare
- Adventitious infections and inherent disease conditions of laboratory animals
- Nonhuman primate-modeled infectious diseases and vaccine development support

**Cytokine Biology
Section****Kathryn C. Zoon, Ph.D., Chief**

www.niaid.nih.gov/labs/aboutlabs/cytokinebiology
301-496-3006

Research Activities

The Cytokine Biology Section (CBS) conducts basic and translational research on human interferons (IFNs). Our studies examine the structure and function of human IFN-alphas using a variety of methods, including protein engineering, gene expression microarrays, proteomics, and bioassays.

CBS is composed of an interactive group of Ph.D., M.D., and interdisciplinary scientists who work in a state-of-the-art building. The laboratory program aims at the following:

- Identifying the structure and function of both naturally occurring and protein-engineered human IFN-alphas
- Examining the interaction of IFN-alpha with its receptor
- Studying the signal transduction pathways of IFN-alphas using gene expression microarrays and proteomics
- Studying the biological effects of IFN-alphas in cell culture and animal models

**Kathryn C. Zoon, Ph.D.**

Director, DIR

Chief, Cytokine Biology Section

www.niaid.nih.gov/labs/aboutlabs/cytokinebiologykzoon@niaid.nih.gov

Dr. Zoon obtained her B.S. cum laude and her Ph.D. in biochemistry from the Johns Hopkins University. Her research focuses on the structure and function of human IFNs. She is an associate editor of the *Journal of Interferon Research* and author or co-author of more than 100 publications. She was past president of the International Society for Interferon and Cytokine Research (2000-2001), served on the board of directors for the Foundation for Advanced Education in the Sciences (FAES) and the International Association of Biologicals, and was the first vice president of FAES.

Prior to joining NIAID in June 2004, Dr. Zoon was principal deputy director of the Center for Cancer Research at the National Cancer Institute, director of the Center for Biologics Evaluation and Research at the FDA, and a member of the NIH Scientific Directors. She has received numerous awards and is a member of the Institute of Medicine.

Major Areas of Research

- Production and characterization of protein-engineered human IFNs
- Interaction of Type I human IFNs with the Type I human IFN receptor
- Signal transduction mechanisms and biological activities of human IFNs
- The antiviral and antiproliferative activities of human IFNs

**Emerging Viral
Pathogens Section****Peter Jahrling, Ph.D., Chief**

[www.niaid.nih.gov/labs/aboutlabs/
emergingViralPathogens](http://www.niaid.nih.gov/labs/aboutlabs/emergingViralPathogens)
301-631-7201

Research Activities

The Emerging Viral Pathogens Section (EVPS) conducts basic research to elucidate the pathophysiological processes associated with infections with viral hemorrhagic fevers and other Category A pathogens. In addition to developing animal models by using authentic microbial agents, EVPS develops treatment strategies that include vaccines, antimicrobials, immunoprophylaxis, and inhibitors of the coagulation cascade and cytokine storm to reverse the consequences of viral infection. Pathogen discovery also is a component of EVPS activities.

Countermeasure development and improved medical outcomes are the objectives of this research initiative. Generic solutions to broad classes of microbial agents should emerge from an understanding of disease processes. Thus, EVPS will assess a broad spectrum of diseases, including newly discovered pathogens, for commonalities amenable to generic intervention strategies.



Peter Jahrling, Ph.D.

Chief, Emerging Viral Pathogens Section

www.niaid.nih.gov/labs/aboutlabs/emergingViralPathogens

jahrlingp@niaid.nih.gov

Dr. Jahrling received his Ph.D. in medical microbiology from Cornell Medical College. Upon graduation, he served as an Army officer at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) where he specialized in viral hemorrhagic fevers requiring biosafety level-4 containment. After fulfillment of his military obligation, Dr. Jahrling converted to civilian status and was eventually appointed scientific advisor for USAMRIID. In 2005, Dr. Jahrling accepted appointments as chief scientist of the NIAID Integrated Research Facility in Frederick, Maryland, and chief of the Emerging Viral Pathogens Section.

Major Areas of Research

- Development of animal models for human diseases involving Category A viral pathogens
- Evaluation of immunization strategies and therapeutic interventions based on antiviral drugs, passive immunization, and targeted reversal of pathophysiological processes
- Isolation and characterization of viral agents associated with previously uncharacterized diseases



Laboratory of Allergic Diseases

Dean D. Metcalfe, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lad
301-496-2165

Sections and Units

Mast Cell Biology Section
Dean D. Metcalfe, M.D.

Molecular Signal Transduction Section
Kirk M. Druey, M.D.

Allergic Inflammation Unit
Joshua D. Milner, M.D.

Inflammation Immunobiology Section
Helene F. Rosenberg, M.D., Ph.D.

Research Activities

The Laboratory of Allergic Diseases (LAD) conducts basic and clinical research on immunologic diseases, with an emphasis on disorders of immediate hypersensitivity. LAD is composed of an interactive group of Ph.D.s., M.D.s., research nurses, technicians, and administrative staff, who work in contemporary laboratories adjacent to NIAID's clinical facilities.

Scientific personnel are engaged in basic and translational research aimed at elucidating events in mast-cell-dependent, IgE-mediated allergic inflammatory reactions, including anaphylaxis, eosinophilic gastrointestinal diseases, and systemic mast cell disorders. Studies are focused on the role of mast cells, basophils, eosinophils, and T lymphocytes and their cytokines. Research objectives include the following:

- Study the growth, differentiation, and activation of mast cells, basophils, and eosinophils
- Elucidate signal transduction pathways in inflammation
- Understand the biological manifestations of effector-cell activation in tissues
- Perform clinical/translational research directed at understanding the pathogenesis of allergic inflammation
- Find novel immunomodulatory and anti-inflammatory approaches to the treatment of allergic and immunologic disorders



Dean D. Metcalfe, M.D.

Chief, Laboratory of Allergic Diseases

Chief, Mast Cell Biology Section, LAD

www.niaid.nih.gov/labs/aboutlabs/lad/mastCellBiologySection

dmetcalfe@niaid.nih.gov

Dr. Metcalfe received his M.D. at the University of Tennessee and an M.S. in microbiology at the University of Michigan, where he also did a residency in internal medicine. Dr. Metcalfe then trained in allergy and immunology during a fellowship at NIAID, followed by training in rheumatology while a fellow in immunology at the Robert Brigham Hospital in Boston. In 1995, he was appointed as the first chief of the newly created Laboratory of Allergic Diseases at NIAID. He is a past president of the American Academy of Allergy, Asthma, and Immunology (AAAAI) and a past chair of the American Board of Allergy and Immunology. Dr. Metcalfe is a fellow of AAAAI and a member of the Association of American Physicians, *Collegium Internationale Allergologicum*, and American Clinical and Climatological Association.

Major Areas of Research

- Identification of mutations and polymorphisms in human disease that affect the mast cell compartment
- Characterization of key signaling pathways in human mast cells that control mast cell responses
- Application of this information to the diagnosis and treatment of anaphylaxis and other allergic and immunologic diseases



Kirk M. Druey, M.D.

Chief, Molecular Signal Transduction Section, LAD

www.niaid.nih.gov/labs/aboutlabs/lad/molecularSignalTransductionSection

kdruey@niaid.nih.gov

Dr. Druey obtained his M.D. from Rush Medical College in Chicago. In 1992, following a residency in internal medicine at the New York Hospital/Cornell Medical Center, Dr. Druey became a postdoctoral fellow in the NIAID Laboratory of Immunoregulation. He joined the Laboratory of Allergic Diseases in 1997 to become chief of the Molecular Signal Transduction Section.

Major Areas of Research

- Basic signaling mechanisms of G-protein-coupled receptors (GPCRs)
- Leukocyte trafficking in allergic inflammation
- GPCR-induced bronchial contraction/relaxation
- Systemic capillary leak syndrome



Joshua D. Milner, M.D.

Chief, Allergic Inflammation Unit, LAD

www.niaid.nih.gov/labs/aboutlabs/lad/allergicInflammation

jdmliner@niaid.nih.gov

Major Areas of Research

- Investigation of defects in T-cell receptor signaling and repertoires
- Clinical and pathophysiologic analysis of patients with known genetic diseases associated with atopy
- Search for novel genetic diseases associated with atopy

Dr. Milner graduated with an S.B. in biology from the Massachusetts Institute of Technology in 1995 and an M.D. with distinction in immunology from the Albert Einstein College of Medicine in 2000. He was the recipient of the Pediatric Scientist Development Program Fellowship and did his fellowship in allergy and immunology at NIAID. He completed a postdoctoral fellowship with Dr. William Paul, examining issues of mouse T-cell receptor repertoires. He was in the NIAID Clinical Research Transition Program immediately prior to being named chief of the Allergic Inflammation Unit as a clinical tenure-track investigator.



Helene F. Rosenberg, M.D., Ph.D.

Chief, Inflammation Immunobiology Section, LAD

www.niaid.nih.gov/labs/aboutlabs/lad/inflammationImmunobiologySection

hrosenberg@niaid.nih.gov

Major Areas of Research

- Eosinophils, eosinophil ribonucleases, and their role in innate immune responses
- Inflammatory responses to and novel immunomodulatory therapies for severe respiratory virus infection
- Diversity and biology of eosinophil and other RNase A family ribonucleases

Dr. Rosenberg was awarded M.D. and Ph.D. degrees from the joint program at the Rockefeller University and Cornell University Medical College in 1984 and 1985, respectively. Following postdoctoral research at Harvard University, she joined NIH in 1991 and became a section chief in 2002.

Laboratory of Clinical Infectious Diseases

Steven M. Holland, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lcid
301-402-7684

Sections and Units

Immunopathogenesis Section
Steven M. Holland, M.D.

Antibacterial Host Defense Unit
Robert S. Munford, M.D.

Tuberculosis Research Section
Clifton E. Barry III, Ph.D.

Clinical Mycology Section
John E. Bennett, M.D.

Bacterial Pathogenesis Unit
Sandip Datta, M.D.

Molecular Microbiology Section
Kyung (June) Kwon-Chung, Ph.D.

Fungal Pathogenesis Unit
Michail S. Lionakis, M.D., Sc.D.

Translational Mycology Unit
Peter Williamson, M.D., Ph.D.

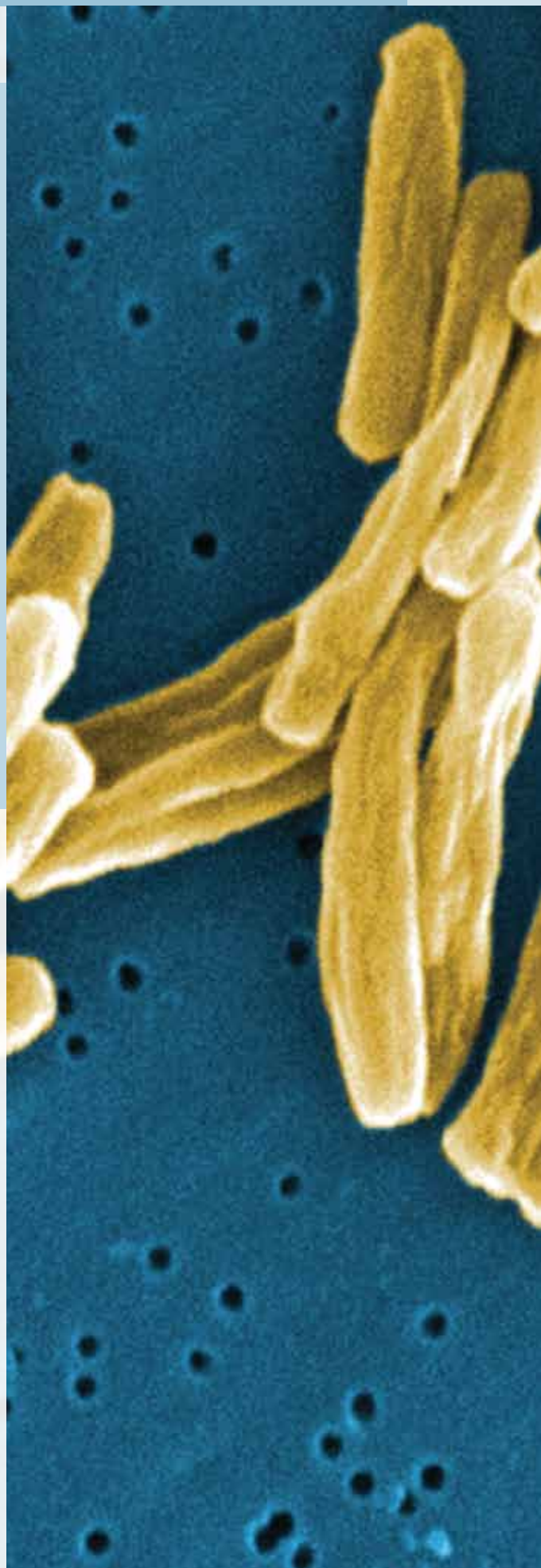
Research Activities

The Laboratory of Clinical Infectious Diseases (LCID) conducts clinical and basic studies of important human infectious and immunologic diseases. Sections of the laboratory focus on mycobacterial, bacterial, and fungal infections, as well as the acquired and congenital immune disorders associated with infection susceptibility and resistance. The program integrates clinical, cellular, and molecular investigation, including animal models and human natural history and therapeutic trials.

The defining feature of LCID is the focus on patients to develop a comprehensive understanding of natural history, pathogenesis, pathophysiology, and management of diseases.

Training of physicians and scientists is central to the LCID mission. The NIAID Infectious Diseases Training Program and the NIH Clinical Center Infectious Disease Consultation Service are located in LCID and are involved in all aspects of clinical and laboratory activities. The integration of these programs into LCID is critical to the reciprocal education of basic scientists and clinical fellows alike.

The major themes of the laboratory center on infections that are recurrent or chronic, as these provide insight into both host and pathogen.





Steven M. Holland, M.D.

Chief, Laboratory of Clinical Infectious Diseases

Chief, Immunopathogenesis Section, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/immunopathSec

smh@nih.gov

Major Areas of Research

- Immune defects of phagocytes: GATA2 deficiency, nontuberculous mycobacterial infections, chronic granulomatous disease, hyper IgE syndrome, leukocyte adhesion deficiency
- Cytokines and their receptors in pathogenesis and therapy
- Susceptibility to disseminated mycobacterial infections
- Mechanisms of mycobacterial pathogenesis
- Mechanisms of airway dysfunction leading to mycobacterial and fungal infection

Dr. Holland received his M.D. from the Johns Hopkins University School of Medicine in 1983, where he stayed as a resident in internal medicine, assistant chief of service in medicine, and fellow in infectious diseases. He came to NIH in 1989 as a National Research Council fellow in the Laboratory of Molecular Microbiology, working on transcriptional regulation of HIV. In 1991, Dr. Holland joined the Laboratory of Host Defenses, shifting his research to the host side, with a focus on phagocyte defects and their associated infections. His work centered on the pathogenesis and management of chronic granulomatous disease, as well as other congenital immune defects affecting phagocytes, including those predisposing to mycobacterial diseases. In 2004, he became chief of LCID.



Robert S. Munford, M.D.

Senior Clinician and Deputy Chief, Laboratory of Clinical Infectious Diseases

Chief, Antibacterial Host Defense Unit, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/AHDS

munfordrs@niaid.nih.gov

Major Areas of Research

- Immunosuppression after LPS exposure in animals
- How human cells regulate the production of acyloxyacyl hydrolase
- How LPS and other molecules induce macrophages to accumulate and retain triglycerides
- How triglyceride retention contributes to pathological outcomes

Dr. Munford received his B.A. in history from Vanderbilt University and his M.A. in animal physiology from Oxford University before attending Harvard Medical School. After training in internal medicine at Parkland Memorial Hospital in Dallas, he served as an epidemic intelligence officer at the CDC, did postdoctoral research at the Rockefeller University, and completed an infectious disease fellowship at Massachusetts General Hospital. He worked for many years as a physician-scientist at the University of Texas Southwestern Medical School in Dallas before moving to NIH in 2009. His interest in bacterial lipopolysaccharides (LPS) began when he investigated an outbreak of meningococcal disease in São Paulo, Brazil, in 1972. His lab's major research goal has been to understand how animals inactivate these highly stimulatory molecules.



Clifton E. Barry III, Ph.D.

Chief, Tuberculosis Research Section, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/tuberculosisresearchsection

cbarry@niaid.nih.gov

Dr. Barry received his Ph.D. in organic and bio-organic chemistry in 1989 from Cornell University. He joined NIAID following postdoctoral research at Johns Hopkins University. In 1998, he was tenured as chief of the Tuberculosis Research Section. His multidisciplinary laboratory includes chemists, biologists, and clinicians dedicated to improving chemotherapy for tuberculosis patients. Dr. Barry is a member of several editorial boards, has authored more than 120 research publications on tuberculosis, and is the most cited researcher in the field, according to ScienceWatch.

Major Areas of Research

- Tuberculosis drug discovery
- Mechanism of action of anti-TB agents
- Drug resistance in *Mycobacterium tuberculosis*
- Chemical biology of the interaction between TB and humans
- Clinical trials of therapies in drug-resistant TB patients
- Molecular imaging of chemotherapy and clinical trials in TB patients
- Advanced diagnostic solutions for TB



John E. Bennett, M.D.

Chief, Clinical Mycology Section, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/clinicalMycologySection

jbennett@niaid.nih.gov

Dr. Bennett received his B.S. in chemistry (cum laude) from Stanford University. He earned his M.D. (Alpha Omega Alpha) from the Johns Hopkins University School of Medicine. Dr. Bennett is board-certified in internal medicine and infectious disease. His other honors include master in the American College of Physicians; former president of the Infectious Diseases Society of America; charter president of the Greater Washington Infectious Diseases Society; member of the American Society for Clinical Investigation and the American Association of Physicians; co-editor of seven editions of *Principles and Practice of Infectious Diseases*; and consultant to the CDC, American College of Physicians-American Society of Internal Medicine, U.S. Public Health Association, FDA, and Department of Defense.

Major Areas of Research

- Molecular mechanisms of azole resistance in *Candida* species
- Cryptococcosis in previously normal patients
- Idiopathic CD4 lymphocytopenia
- Clinical trials of antifungal agents



Sandip K. Datta, M.D.

Chief, Bacterial Pathogenesis Unit, LCID

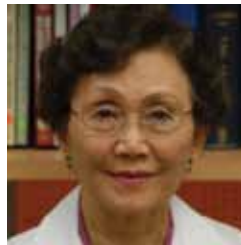
www.niaid.nih.gov/labs/aboutlabs/lcid/bacPathogenSection

dattas@niaid.nih.gov

Major Areas of Research

- Host defense against bacteria
- Development of adaptive immunity after bacterial infection
- Interaction of innate and adaptive immune systems after bacterial infection

Dr. Datta received his M.D. from the University of California, San Francisco, in 1996. He then completed his residency in internal medicine and fellowship in infectious diseases at the University of California, San Diego (UCSD), including postdoctoral training with Dr. Eyal Raz. Dr. Datta was appointed as assistant professor of medicine at UCSD in 2004. In February 2008, he joined LCID as tenure-track chief of the newly formed Bacterial Pathogenesis Unit.



Kyung (June) Kwon-Chung, Ph.D.

Chief, Molecular Microbiology Section, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/molecularmicrobiologysection

jkchung@niaid.nih.gov

Major Areas of Research

- Virulence determinants of *Cryptococcus neoformans* and *Aspergillus fumigatus*
- Mechanism by which *C. neoformans* invades the brain
- Mechanism by which cryptococci adapt to the brain environment and produce fulminating disease
- Signaling mechanism involved in the cryptococcal invasion of human brain microvascular endothelial cells
- Relationship between cryptococcal adaptation to azole drugs and azole therapy failure
- Identification of genes differentially expressed in spores and hyphae upon exposure to human neutrophils
- Construction of isogenic strains for genetic analysis
- Pathogenic difference between *A. fumigatus* and *A. nidulans* in chronic granulomatous disease patients

Dr. Kwon-Chung received her B.S. and M.S. in biology from Ewha Womans University in Seoul, South Korea, prior to receiving a Fulbright Scholarship to pursue her doctoral work in the bacteriology department at the University of Wisconsin, Madison. After receiving her Ph.D., she joined the Medical Mycology Section of the NIAID Laboratory of Microbiology as a visiting fellow. She became a senior investigator in the NIAID Laboratory of Clinical Investigation in 1973 and has been the chief of the Molecular Microbiology Section since 1995.



Michail S. Lionakis, M.D., Sc.D.

Chief, Fungal Pathogenesis Unit, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/fungalPathogenesis

lionakism@mail.nih.gov

Dr. Lionakis obtained his M.D. and Sc.D. from the University of Crete in Greece. In 2002, he worked as a research fellow at the University of Texas MD Anderson Cancer Center (MDACC) under the mentorship of Dimitrios Kontoyiannis. After completing his clinical training in internal medicine at Baylor College of Medicine and in infectious diseases at NIAID, Dr. Lionakis joined the Laboratory of Molecular Immunology (LMI) in 2008 and began work on fungal immunology under the mentorship of Dr. Philip Murphy. In 2010, he was recruited as an assistant clinical investigator in the NIAID Transition Program in Clinical Research and established the LMI Clinical Mycology Unit. In 2012, Dr. Lionakis was recruited as a tenure-track investigator and established the Fungal Pathogenesis Unit within the Laboratory of Clinical Infectious Diseases.

Major Areas of Research

- Role of chemotactic factors in host defense against invasive candidiasis
- Role of innate immune cells in antifungal host defense
- Genetic susceptibility to infection in mice and patients with candidiasis
- Organ-specific immunity in invasive candidiasis
- Susceptibility to chronic mucocutaneous candidiasis in patients with autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy syndrome



Peter Williamson, M.D., Ph.D.

Chief, Translational Mycology Unit, LCID

www.niaid.nih.gov/labs/aboutlabs/lcid/TranslationalMycology

peter.williamson2@nih.gov

Dr. Williamson received his M.D./Ph.D. from Boston University in 1987 and completed a residency in internal medicine at Georgetown University before coming to NIH for a fellowship in infectious diseases. In 1995, Dr. Williamson joined the faculty at the University of Illinois at Chicago as an assistant professor of medicine in the section of infectious diseases. After progressing to the rank of professor of medicine, pathology, microbiology, and immunology, Dr. Williamson returned to NIH to head the Translational Mycology Unit in the Laboratory of Clinical Infectious Diseases.

Major Areas of Research

- *Cryptococcus* in meningeal infections
- Regulation of autophagy by *Cryptococcus* in latent and active infections
- TOR-dependent regulation of autophagic-associated phagocytosis in macrophages
- Genetic susceptibility to infections by *Cryptococcus* and *Candida albicans*
- Transcriptional profiling of primary immune deficiencies and autoimmune diseases
- Early markers of cryptococcal disease and immune reconstitution syndrome

Laboratory of Host Defenses**Harry L. Malech, M.D., Chief**

www.niaid.nih.gov/labs/aboutlabs/lhd
301-480-6916

Sections and Units

Genetic Immunotherapy Section
Harry L. Malech, M.D.

Clinical Pathophysiology Section
John I. Gallin, M.D.

Molecular Defenses Section
Thomas L. Leto, Ph.D.

Mucosal Immunity Section
Warren Strober, M.D.

Human Immunological Diseases Unit
Helen C. Su, M.D., Ph.D.

Research Activities

The Laboratory of Host Defenses (LHD) studies the immune functions essential for host defense against infection. LHD also studies the genetics and pathophysiology of inherited primary immune deficiencies. These abnormalities may be associated with recurrent infections and/or dysfunctions of immune homeostasis, which the lab investigates in clinical protocols.

LHD clinical investigations aim to develop new diagnostic and therapeutic approaches to the management or correction of immune dysfunction in patients. These investigations include the following:

- Discovery of the gene mutations causing primary immune deficiencies and autoimmune disorders
- Detection and treatment of associated infections
- Determination of the basis for excessive inflammation and associated autoimmune symptoms
- Use of cytokines, monoclonal antibodies, gene transfer technologies, and other therapeutics to modify or correct immune function, prevent infection, and reduce inflammation
- Application of gene therapy and allogeneic or autologous stem cell and immune cell transplantation for the correction of disorders of immune function



Harry Malech, M.D.

Chief, Laboratory of Host Defenses

Chief, Genetic Immunotherapy Section, LHD

www.niaid.nih.gov/labs/aboutlabs/lhd/geneticImmunotherapySection

hmalech@nih.gov

Dr. Malech received his medical degree from Yale University in 1972. He completed clinical residency training at the University of Pennsylvania, followed by basic research postdoctoral fellowship training at NIH. After completing clinical fellowship training in infectious diseases at Yale, he remained there as an assistant and then associate professor until 1986. He then returned to NIH as a senior investigator. He currently is chief of the Laboratory of Host Defenses and its Genetic Immunotherapy Section.

Major Areas of Research

- Gene therapy using *ex vivo* transduction of autologous CD34+ hematopoietic stem cells
- Allogeneic transplantation using hematopoietic stem cell grafts
- Chronic granulomatous disease
- X-linked severe combined immune deficiency
- Leukocyte adhesion deficiency
- WHIM syndrome
- Acute and chronic graft-versus-host disease
- Biology of engraftment of hematopoietic stem cells and the role of the CXCR4 chemokine receptor
- Excessive inflammation and associated autoimmune symptoms with primary immune deficiencies
- Induced pluripotent stem cells used to model human immune deficiencies and for development of novel treatments



John I. Gallin, M.D.

Director, NIH Clinical Center

Chief, Clinical Pathophysiology Section, LHD

www.niaid.nih.gov/labs/aboutlabs/lhd/clinicalPathophysiologySection

jgallin@cc.nih.gov

Dr. Gallin received his medical training at Cornell University Medical College, followed by residency in internal medicine at Bellevue Hospital in New York City. In 1971, he first came to NIH as a clinical associate. In 1974, he served as senior chief resident in medicine at Bellevue Hospital before returning to NIH in 1976 as a senior investigator. Dr. Gallin has served as scientific director of the NIAID intramural research program (1985–1994) and as chief of the Laboratory of Host Defenses (1991–2003). Since 1994, Dr. Gallin has been director of the NIH Clinical Center. Dr. Gallin is a master of the American College of Physicians and a member of the Association of American Physicians, the American Society of Clinical Investigation, the American Association of Immunologists, and the Institute of Medicine of the National Academy of Sciences.

Major Areas of Research

- Inflammation
- Phagocyte dysfunction



Thomas L. Leto, Ph.D.

Chief, Molecular Defenses Section, LHD

www.niaid.nih.gov/labs/aboutlabs/lhd/molecularDefensesSection

tletto@nih.gov

Major Areas of Research

- Nox family NADPH oxidases
- Reactive oxygen-dependent innate immune mechanisms in phagocytic cells and on mucosal surfaces
- Role of reactive oxygen in health and disease

Dr. Leto received his Ph.D. in biochemistry from the University of Virginia for studies on mechanisms of cell membrane assembly. He followed this work with postdoctoral studies at Yale University on membrane cytoskeleton interactions. Dr. Leto joined NIAID in 1988 and became a senior investigator in the Laboratory of Host Defenses in 1996.



Warren Strober, M.D.

Chief, Mucosal Immunity Section, LHD

www.niaid.nih.gov/labs/aboutlabs/lhd/mucosalImmunitySection

wstrober@niaid.nih.gov

Major Areas of Research

- Basic studies of mucosal immunity, mucosal inflammation, and inflammatory bowel diseases
- Studies of immunodeficiency such as common variable immunodeficiency and hyper-IgM syndrome
- Studies of the immunobiology of interleukin 12
- Studies of innate immunity in the mucosal immune system

Dr. Strober obtained his medical degree from the University of Rochester and completed an internship and residency at Strong Memorial Hospital. He has served as the deputy scientific director of NIAID and as the interim scientific director of the National Institute of Arthritis and Musculoskeletal and Skin Diseases. Dr. Strober is the recipient of numerous awards, including the Distinguished Achievement Award of the American Gastroenterological Association and the U.S. Public Health Service Distinguished Achievement Medal. He has served as chair of the American Board of Allergy and Immunology and as president of the Society for Mucosal Immunity.

**Helen Su, M.D., Ph.D.**

Chief, Human Immunological Diseases Unit, LHD

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Dr. Su received her M.D. and Ph.D. from Brown University. She completed training in pediatrics at St. Louis Children's Hospital, Washington University, and subspecialty training in allergy and immunology at NIAID. After postdoctoral training with Dr. Michael Lenardo in the NIAID Laboratory of Immunology, she joined the Laboratory of Host Defenses in 2007 as a tenure-track clinical investigator.

Major Areas of Research

- Defining the molecular mechanisms of new inherited human immunological diseases
- Understanding DOCK8 function in health and disease



Laboratory of Human Bacterial Pathogenesis

Frank R. DeLeo, Ph.D., Acting Chief

www.niaid.nih.gov/labs/aboutlabs/lhbp
406-363-9448

Sections and Units

Pathogen-Host Cell Biology Section
Frank R. DeLeo, Ph.D.

Pathogen Molecular Genetics Section
Michael Otto, Ph.D.

Research Activities

The Laboratory of Human Bacterial Pathogenesis (LHBP) studies the molecular basis of human bacterial pathogenesis in its broadest sense. Research projects currently focus on *Staphylococcus*-host interactions, with special emphasis on the virulence mechanisms of community-associated methicillin-resistant *Staphylococcus aureus*.

LHBP scientists study mechanisms of staphylococcal virulence, innate immune responses to pathogenic bacteria, and the role of neutrophils in host defense. In addition, mechanisms of immune evasion, such as the formation of biofilms, are a major area of investigation. Genome-wide strategies are used, such as high-throughput DNA sequencing and expression-array analysis. LHBP goals are as follows:

- Understand the fundamental molecular mechanisms of bacterial pathogen-host interactions
- Develop new strategies to control bacterial infections
- Identify host genetic factors influencing disease character
- Define the cell biology of pathogen-host interactions



Frank R. DeLeo, Ph.D.

Acting Chief, Laboratory of Human Bacterial Pathogenesis

Chief, Pathogen-Host Cell Biology Section, LHBP

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Dr. DeLeo received his Ph.D. in microbiology from Montana State University in 1996, studying the molecular basis of superoxide generation by human neutrophils. He did his postdoctoral training in the area of innate immunity and infectious disease in the department of medicine at the University of Iowa (1996-2000). Dr. DeLeo joined the staff at NIAID's Rocky Mountain Laboratories in 2000. He currently serves on the editorial boards of *Infection and Immunity*, *Apoptosis*, and *PLoS Pathogens*.

Major Areas of Research

- Neutrophil biology and function
- Interaction of MRSA and human neutrophils
- *Staphylococcus aureus* virulence mechanisms
- Clinically related research performed in collaboration with DIR laboratories in Bethesda, Maryland



Michael Otto, Ph.D.

Chief, Pathogen Molecular Genetics Section, LHBP

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Dr. Otto received his M.S. in biochemistry in 1993 from the University of Tuebingen, Germany. In 1998, he earned his Ph.D. in microbiology from the same institution. Dr. Otto joined the Laboratory of Human Bacterial Pathogenesis in July 2001 as a principal investigator. In 2008, he became a tenured senior investigator and moved his laboratory to the NIH Bethesda campus.

Major Areas of Research

- Physiology of staphylococcal biofilms and biofilm-associated infection
- Molecular basis of immune evasion mechanisms in staphylococci: exopolymers, proteases, toxins, antimicrobial peptide resistance
- Community- and hospital-associated MRSA: virulence determinants and epidemiology
- Gene regulatory processes during pathogen-host interaction



Laboratory of Immunogenetics

Susan K. Pierce, Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lig
301-496-9589

Sections and Units

Lymphocyte Activation Section
Susan K. Pierce, Ph.D.

Autoimmunity and Functional Genomics Section
Silvia Bolland, Ph.D.

Receptor Cell Biology Section
John E. Coligan, Ph.D.

Malaria Infection Biology and Immunity Unit
Peter D. Crompton, M.D., M.P.H

Chemotaxis Signal Section
Tian Jin, Ph.D.

Molecular Pathology Section
Victor V. Lobanenko, Ph.D.

Molecular and Cellular Immunology Section
Eric O. Long, Ph.D.

T-Cell Tolerance and Memory Section
Polly Matzinger, Ph.D.

Virology and Cellular Immunology Section
Herbert C. Morse III, M.D.

Structural Immunology Section
Peter D. Sun, Ph.D.

Research Activities

Research in the Laboratory of Immunogenetics (LIG) focuses broadly on the cellular and molecular mechanisms that underlie the receptor-mediated activation of immune cells. LIG researchers aim to understand immune-cell activation in autoimmune diseases, with particular focus on systemic lupus erythematosus; in infectious diseases, with emphasis on malaria; and in lymphoid tumors, with a view toward identifying targets for the development of therapies and vaccines.

Research encompasses a wide spectrum of experimental approaches, from the structural determination of immune-cell receptors to genetic analysis of autoimmune phenotypes, live cell imaging of the behavior of chemotactic receptors, and field studies in Africa. Research programs focus on identifying genes that confer susceptibility and resistance to autoimmune disease and understanding how they function; determining the molecular basis of the initiation of receptor signaling in the activation of B cells and NK cells and in chemotaxis; understanding the structural basis of NK-cell recognition of their target cells; and determining the mechanisms involved in the generation and maintenance of immunological memory in malaria.

Laboratory members are highly interactive, creating a unique environment in which structural biology, molecular biology, cell biology, and infection biology interface.



Susan K. Pierce, Ph.D.

Chief, Laboratory of Immunogenetics

Chief, Lymphocyte Activation Section, LIG

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Dr. Pierce became chief of the NIAID Laboratory of Immunogenetics in 1999. Prior to joining NIAID, she was a member of the faculty at Northwestern University, where she held the Cook Chair in the Biological Sciences. She earned her Ph.D. in immunology from the University of Pennsylvania in 1976.

Major Areas of Research

- Regulation of the antigen-driven initiation of B-cell-receptor signaling
- Generation and maintenance of immunological memory in malaria



Silvia Bolland, Ph.D.

Chief, Autoimmunity and Functional Genomics Section, LIG

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Dr. Bolland received her Ph.D. in molecular biology from the University of Cantabria, Spain, and received postdoctoral training at Harvard and the Rockefeller University. She joined the NIAID Laboratory of Immunogenetics in September 2001. She is the recipient of an S.L.E. Foundation Career Development Award and a Novel Research Grant Award from the Lupus Research Institute.

Major Areas of Research

- Identification of new genetic modifiers of systemic autoimmune disease
- Dose effect of Toll-like receptor genes and its role in autoimmune pathologies
- Inhibitory signaling pathways mediated by the IgG Fc receptor (Fc gamma RIIB) and the phosphoinositol 5-phosphatase (SHIP)



John E. Coligan, Ph.D.

Chief, Receptor Cell Biology Section, LIG

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Major Areas of Research

- Regulation of expression and function of the human NKG2D/DAP10 and CD16 receptors expressed by NK and T cells
- Understanding the biological processes that regulate the intracellular transport and release of NK cell cytolytic and cytokine-bearing granules
- Determination of the ligands and function of orphan lymphoid/myeloid cell inhibitory receptors

Dr. Coligan received his Ph.D. from Indiana University and did postdoctoral research at the City of Hope Research Institute near Los Angeles. After two years as an assistant professor at Rockefeller University, he was a founding member of the Laboratory of Immunogenetics. He has served as head of the Biological Resources Branch and Laboratory of Molecular Structure. In 1998, he joined the Laboratory of Allergic Diseases and became chief of the Receptor Cell Biology Section. In 2007, this section moved to the Laboratory of Immunogenetics.



Peter D. Crompton, M.D., M.P.H.

Chief, Malaria Infection Biology and Immunity Unit, LIG

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Major Areas of Research

- Mechanisms of naturally acquired immunity to malaria
- Antibody responses to *Plasmodium falciparum* infection
- B- and T-cell biology of *P. falciparum* infection
- Regulation of *P. falciparum*-induced inflammation
- Systems immunology of human malaria

Dr. Crompton received his M.D. and M.P.H. from the Johns Hopkins Schools of Medicine and Public Health in 2000. He then completed a residency in internal medicine at Massachusetts General Hospital/Harvard University before going on to a fellowship in infectious diseases at NIAID in 2004. After a year of clinical training at NIAID, he earned a diploma in tropical medicine and hygiene at the London School of Hygiene and Tropical Medicine before joining the NIAID Laboratory of Immunogenetics (LIG) in 2005 to pursue research on the human immune response to malaria. In 2010, he became a tenure-track investigator and chief of the Malaria Infection Biology and Immunity Unit within LIG. Dr. Crompton is certified in internal medicine and infectious disease by the American Board of Internal Medicine. In 2012, Dr. Crompton was awarded a Presidential Early Career Award for Scientists and Engineers.



Tian Jin, Ph.D.

Chief, Chemotaxis Signal Section, LIG

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Dr. Jin received his B.S. in biology from Peking University, China, in 1984 and his Ph.D. from the department of biochemistry at the Robert Wood Johnson Medical School at Rutgers-UMDNJ in 1994. From 1994 to 2000, he was a postdoctoral fellow in the department of biological chemistry at the Johns Hopkins University School of Medicine. Dr. Jin was appointed instructor in the department of cell biology and anatomy at Johns Hopkins in 2001. In July 2001, he joined the NIAID Laboratory of Immunogenetics as a tenure-track investigator. In 2009, he became a senior investigator.

Major Areas of Research

- Mechanisms underlying GPCR-mediated chemotaxis in *Dictyostelium discoideum*
- Mechanisms involved in chemotaxis of immune and cancer cells



Victor V. Lobanenko, Ph.D.

Chief, Molecular Pathology Section, LIG

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Dr. Lobanenko received an M.A. in nuclear physics from the Institute of Physics in 1977 and a Ph.D. in experimental oncology from the Cancer Research Center, Moscow, in 1981. He was molecular carcinogenesis team leader in the All-Union Cancer Center of the former U.S.S.R. and a visiting scholar at the Royal Cancer Hospital, London, until 1990, where he discovered avian CTCF. He was invited to the Fred Hutchinson Cancer Research Center in Seattle as a foreign faculty-in-residence funded by NIH grants. In 1999, he became chief of the Molecular Pathology Section in the Laboratory of Immunopathology; identified CTCF in *Drosophila*, mice, and man; and characterized the novel BORIS+CTCF gene family universally involved in epigenetic regulation of mammalian cellular and viral genomes. His section, which moved to the Laboratory of Immunogenetics in 2012, works to understand how genome-wide, CTCF/BORIS-binding sequences regulate different functions, including inter- and intra-chromosomal 3D DNA-looping interactions, mono-allelic expression of imprinted and non-imprinted genes, X-chromosome inactivation, and regulation of stem/germ cell-specific promoters associated with targeted DNA demethylation.

Major Areas of Research

- Three classes of CTCF/BORIS binding in epigenetic regulation
- Regulation of BORIS and its targets in cellular and viral genomes
- Translational research of BORIS repressors and of anti-BORIS immune responses directed to cancer diagnostics, therapy, and anti-tumor vaccination



Eric O. Long, Ph.D.

Chief, Molecular and Cellular Immunology Section, LIG

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Major Areas of Research

- Signaling pathways for activation and inhibition of NK cells
- Live imaging of NK-cell immunological synapses
- Endosomal signaling by internalized receptors

Dr. Long obtained a Ph.D. from the University of Geneva, Switzerland, and trained as a postdoctoral fellow at the National Cancer Institute. As a junior faculty member at the University of Geneva, he isolated the first molecular clones for MHC class II. After joining NIAID in 1983, he described new processing pathways for antigen presentation to CD4 T cells. He became chief of the Molecular and Cellular Immunology Section in 1988. In 1995, his group identified a family of inhibitory receptors on NK cells. Since then, his lab has defined signaling pathways for granule polarization and degranulation, as well as inhibitory mechanisms that control NK-cell cytotoxicity.



Polly Matzinger, Ph.D.

Chief, T-Cell Tolerance and Memory Section, LIG

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Major Areas of Research

- Danger model of immunity
- Tissue-based class control
- Immune tolerance and activation

Dr. Matzinger obtained her Ph.D. in biology from the University of California-San Diego for the study of T-cell tolerance. Following four years of postdoctoral research at Cambridge University and six years at the Basel Institute of Immunology, Switzerland, she joined the Laboratory of Cellular and Molecular Immunology in 1989. She became a section chief in 1995. Her research focuses on the fundamental principles by which the immune system operates and is based on the “danger” model of immunity and its extension, the tissue-control model. In 2013, her section joined the Laboratory of Immunogenetics.



Herbert C. Morse III, M.D.

Chief, Virology and Cellular Immunology Section, LIG

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Dr. Morse graduated from Harvard Medical School and completed his internship and residency at Peter Bent Brigham Hospital in Boston. Following postdoctoral studies, he joined the NIAID Laboratory of Viral Diseases in 1980 and became chief of the Laboratory of Immunopathology (LIP) in 1985. In 2011, LIP merged with the Laboratory of Immunogenetics, and Dr. Morse became chief of the Virology and Cellular Immunology Section.

Major Areas of Research

- Hematopoietic development and function in health and disease
- Pathogenesis of autoimmune and inflammatory diseases
- Mechanisms of lymphoma/leukemia development



Peter D. Sun, Ph.D.

Chief, Structural Immunology Section, LIG

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Dr. Sun obtained his Ph.D. from the Molecular Biology Institute, University of Oregon, for the study of structure and thermostability of the phage T4 lysozyme using X-ray crystallography. He then joined the National Institute of Diabetes and Digestive and Kidney Diseases for his postdoctoral training in 1991, focusing on the structure and function of cytokines. In particular, he determined the crystal structure of a human transforming growth factor, TGF-beta 2. He joined NIAID in 1994.

Major Areas of Research

- Structural immunology
- Structure and function of NK-cell receptors
- Structural mechanisms of HIV and host interactions

William E. Paul, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/li
301-496-5046

Sections and Units

Cytokine Biology Unit

William E. Paul, M.D.

T-Cell Development Section

B.J. Fowlkes, Ph.D.

Molecular Development of the Immune System Section

Michael J. Lenardo, M.D.

Molecular Biology Section

David H. Margulies, M.D., Ph.D.

Integrative Immunobiology Unit

Stefan A. Muljo, Ph.D.

Cellular Immunology Section

Ethan M. Shevach, M.D.

Structural Immunobiology Unit

Tsan Sam Xiao, Ph.D.

Molecular and Cellular Immunoregulation Unit

Jinfang (Jeff) Zhu, Ph.D.

Research Activities

The major research activities of Laboratory of Immunology (LI) scientists focus on the basic genetics, molecular biology, cell biology, and cellular immunology of the immune system. How dysregulation of the immune system results in autoimmune diseases and what strategies might be valuable for vaccine development are important topics of interest. Specific areas of current investigation are as follows:

- Structure of pattern recognition receptors
- miRNA regulation of immune cell function
- T-cell development, differentiation, and plasticity
- Transcriptional regulation of lymphocyte differentiation
- Regulation of primary and secondary immune responses
- Cytokine biology, transcriptional networks, and signaling mechanisms
- Programmed cell death and autophagy
- Biology of regulatory T cells and control of autoimmunity
- Role of T regulatory cells in chronic infection
- Induction of T-cell tolerance and treatment of autoimmunity
- Lymphocyte dynamics
- Structure and function of viral immunoevasins
- Analysis of genetically determined defects in human T-cell death



William E. Paul, M.D.

Chief, Laboratory of Immunology

Chief, Cytokine Biology Unit, LI

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Chief of the Laboratory of Immunology (LI) since 1970, Dr. Paul served as director of the NIH Office of AIDS Research and as NIH Associate Director for AIDS Research from 1994 to 1997. He is the founding editor of the *Annual Review of Immunology* and is a member of the editorial boards of *Immunity* and the *Proceedings of the National Academy of Sciences*. He is a member of the National Academy of Sciences, its Institute of Medicine, and the Association of American Physicians. He also is a fellow of the American Academy of Arts and Sciences. He was president of the American Association of Immunologists and the American Society for Clinical Investigation. His honors include the Founders Prize, Texas Instruments Foundation; Life Sciences Award, Federation of American Societies for Experimental Biology; Abbott Laboratories Award in Clinical and Diagnostic Immunology; and the Max Delbrück Medal. Dr. Paul is the recipient of honorary degrees from the State University of New York, the Hebrew University of Jerusalem, the University of Rome La Sapienza, and the National University of Athens, among others. He is an adjunct professor at the University of Pennsylvania School of Medicine and a Raymond and Beverly Sackler Senior Professor by Special Appointment at Tel Aviv University.

Major Areas of Research

- Cytokines: characterization, regulation of production, mode of action, and mechanism of receptor function
- Regulation of lymphocyte activation, differentiation, and proliferation
- Lymphocyte dynamics in health and in chronic infection, including HIV
- Immunologic memory and strategies for vaccine development



B.J. Fowlkes, Ph.D.

Chief, T-Cell Development Section, LI

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After receiving an M.S. from the Medical College of Virginia for studies in *Drosophila* genetics, Dr. Fowlkes conducted research on cancer at the National Cancer Institute and on immunology at NIAID. She received her Ph.D. for studies on thymocyte differentiation at the George Washington University. She joined the NIAID Laboratory of Cellular and Molecular Immunology in 1987, was tenured as a senior investigator in 1990, and was appointed chief of the T-Cell Development Section in 1992. Since 1999, she has served as adjunct professor of genetics and of microbiology/immunology at the George Washington University. She serves on numerous editorial and scientific advisory boards and is a recipient of a Roche Basic Science Award, NIH Merit Award, and the American Association of Immunology Investigator Award for outstanding contributions to immunology. In 2013, her section joined the Laboratory of Immunology.

Major Areas of Research

- T-cell development
- Thymic selection
- T-lineage commitment



Michael J. Lenardo, M.D.

Chief, Molecular Development of the Immune System Section, LI

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Major Areas of Research

- Genetic diseases of immune homeostasis and autoimmunity
- Non-apoptotic mechanisms of cell death
- Development of novel immunodiagnostics and immunotherapeutics
- Physiology of Mg^{2+} as a second messenger in signal transduction

Dr. Lenardo graduated with a B.A. from the Johns Hopkins University and an M.D. from Washington University, St. Louis. He performed clinical work in internal medicine and research at the University of Iowa and received postdoctoral training at the Whitehead Institute for Biomedical Research at the Massachusetts Institute of Technology. He established an independent research unit in the Laboratory of Immunology in 1989 and became a senior investigator and section chief in 1994. Dr. Lenardo serves on several editorial boards and has given numerous lectures around the world on his work on the molecular regulation of immune homeostasis. His work focuses on lymphocyte apoptosis, autoimmunity, and HIV pathogenesis. He was the creator and former director of the NIH-Oxford-Cambridge Scholars program for doctoral training.



David H. Margulies, M.D., Ph.D.

Chief, Molecular Biology Section, LI

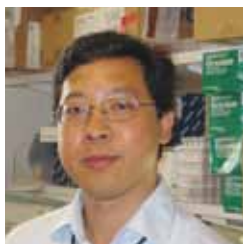
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Major Areas of Research

- MHC class I and class II molecules: structure, function, interactions with ligands, and mechanism of antigen processing and presentation
- Viral immunoevasins and related molecules encoded by the cytomegaloviruses that are structurally related to MHC-I molecules
- T-cell receptors: structure, function, and interactions with MHC and with coreceptors CD8 and CD4
- NK cell receptors: structure, function, and interactions with MHC-I molecules and with viral immunoevasins
- Molecular mechanisms of autoimmunity and drug-induced hypersensitivity

Dr. Margulies received his A.B. from Columbia University in 1971, followed by his M.D. and Ph.D. from the Albert Einstein College of Medicine in 1978. He trained in internal medicine at Columbia/Presbyterian Medical Center from 1978 to 1980 and came to NIH in 1980, working first as a research associate in the Laboratory of Molecular Genetics at the Eunice Kennedy Shriver National Institute of Child Health and Human Development and then moving to the Laboratory of Immunology (LI) at NIAID as an investigator. Since 1987, he has been a senior investigator and chief of the Molecular Biology Section of LI, where his laboratory has studied fundamental aspects of the molecular basis of cell-cell communication in the immune response, with particular emphasis on viral immunity, autoimmunity, and drug hypersensitivity.



Stefan A. Muljo, Ph.D.

Chief, Integrative Immunobiology Unit, LI

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Dr. Muljo joined the Laboratory of Immunology (LI) in July 2008 to head the Integrative Immunobiology Unit. He earned his Ph.D. from the Graduate Program in Immunology at the Johns Hopkins University School of Medicine. Part of his dissertation work was performed at the department of molecular and cell biology in the division of immunology and pathogenesis, University of California, Berkeley. This was followed by a postdoctoral fellowship at the Immune Disease Institute (formerly the Center for Blood Research) at Harvard Medical School.

Major Areas of Research

- Non-coding RNAs: characterization under physiological and pathological conditions, regulation of production, mechanisms of action, identification of cognate targets
- Gene expression and its regulation in hematopoietic stem cells and during cellular differentiation
- Application of small RNAs for modulating or enhancing immune responses
- MicroRNA expression profiling to identify novel biomarkers



Ethan M. Shevach, M.D.

Chief, Cellular Immunology Section, LI

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Dr. Shevach received his M.D. from Boston University in 1967. Following clinical training, he joined the Laboratory of Immunology as a senior staff fellow in 1972, was appointed a senior investigator in 1973, and became a section chief in 1987. Dr. Shevach served as editor-in-chief of the *Journal of Immunology* from 1987 to 1992 and editor-in-chief of *Cellular Immunology* from 1996 to 2007. He received the 2004 William B. Coley Award for Distinguished Research in Basic and Tumor Immunology.

Major Areas of Research

- Roles of thymic-derived regulatory T cells and peripherally induced regulatory T cells in immune responses
- Role of regulatory T cells (Tregs) in the immune response to infectious agents
- Mechanisms of action of Foxp3⁺ Tregs
- Studies on human Foxp3⁺ Tregs



Tsan Sam Xiao, Ph.D.

Chief, Structural Immunobiology Unit, LI

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Major Areas of Research

- Structural studies of innate immune receptors for nucleic acids
- Mechanisms of inflammasome activation by ligands from host and microbial sources
- Innate signaling mechanisms mediated by adapter molecules

Dr. Xiao received his Ph.D. in molecular biophysics from the University of Texas Southwestern Medical Center in Dallas, where he studied essential signal-transducing molecules involved in *Drosophila* innate immunity and development. Following his postdoctoral research on integrins at Harvard Medical School, he joined the Laboratory of Immunology in the spring of 2006.



Jinfang (Jeff) Zhu, Ph.D.

Chief, Molecular and Cellular Immunoregulation Unit, LI

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Major Areas of Research

- Diversity and plasticity of T helper (Th) subsets
- Transcriptional regulation of Th-cell lineage-specific genes
- Cellular/molecular requirements for the development of distinct Th subsets
- Transcriptional regulation in other immune cells

Dr. Zhu received his bachelor's degree summa cum laude from the department of biology, NanKai University, Tianjin, China, and his Ph.D. in biochemistry and molecular biology from the Shanghai Institute of Biochemistry (now known as Shanghai Institute of Biochemistry and Cell Biology), Chinese Academy of Sciences. He joined the Laboratory of Immunology (LI) first as a visiting fellow and then as a staff scientist studying CD4 T-cell differentiation. He became a principal investigator in LI in October 2011. He investigates heterogeneity and plasticity of immune cells and their functions during normal and pathological immune responses at cellular and molecular levels. His focus is on the induction and functions of transcription factor complexes during development, lineage commitment, and maintenance of immune cells, particularly CD4 T helper cells.

Laboratory of Immunoregulation

Anthony S. Fauci, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lir
301-496-1124

Sections and Units

Immunopathogenesis Section
Anthony S. Fauci, M.D.

HIV-Specific Immunity Section
Mark Connors, M.D.

Clinical Research Section
Richard Davey, M.D.

B-Cell Molecular Immunology Section
John H. Kehrl, M.D.

Clinical and Molecular Retrovirology Section
H. Clifford Lane, M.D.

Viral Pathogenesis Section
Paolo Lusso, M.D., Ph.D.

International HIV/STD Section
Thomas C. Quinn, M.D.
Steven J. Reynolds, M.D., M.P.H.

HIV Pathogenesis Unit
Irina Sereti, M.D.

Research Activities

The major theme of the Laboratory of Immunoregulation (LIR) continues to be the elucidation of cellular and molecular mechanisms regulating the human immune response in health and disease. A major component of these efforts is the study of the immunopathogenic mechanisms of HIV infection and disease progression.

Our investigation of host factors involved in the evolution of HIV disease indicates that HIV pathogenesis is a multifactorial and multiphasic process. LIR investigates the following important aspects of this process:

- Regulation of HIV replication by endogenous cytokines and chemokines
- Regulation of expression of HIV coreceptors
- HIV envelope-mediated intracellular signaling events responsible for immune dysfunction
- Role of a latent, inducible reservoir of HIV-infected cells in the pathogenesis of HIV disease and its implications for antiretroviral therapy
- Contribution of HIV-infected T cells, B cells, dendritic cells, monocytes/macrophages, and multipotent progenitor cells to disease pathogenesis
- Role of immunomodulation in immune reconstitution during antiretroviral therapy for HIV infection

LIR researchers conduct clinical trials to determine the safety and efficacy of drugs for the treatment of HIV infection and its complications and the development of methods for immunologic reconstitution in HIV-infected individuals. Studies of the epidemiology and pathogenesis of HIV infection and other sexually transmitted diseases are both domestic and international.



Anthony S. Fauci, M.D.

Director, NIAID

Chief, Laboratory of Immunoregulation

Chief, Immunopathogenesis Section, LIR

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Major Areas of Research

- Roles of latently infected, resting CD4+ T cells, B cells, and innate immunity in the pathogenesis and treatment of HIV disease
- Role of HIV envelope signaling in viral replication and immune dysfunction
- Therapeutic strategies for management of hepatitis C/HIV co-infection
- Novel approaches to the inhibition of HIV binding and entry into CD4+ T cells
- Novel approaches to the treatment of recently acquired and chronic HIV infection

Dr. Fauci received his A.B. from the College of the Holy Cross and his M.D. from Cornell University Medical College. He then completed an internship and residency at the New York Hospital-Cornell Medical Center. In 1968, Dr. Fauci came to NIH as a clinical associate in the NIAID Laboratory of Clinical Investigation. In 1980, he was appointed chief of the Laboratory of Immunoregulation, a position he still holds. Dr. Fauci became director of NIAID in 1984. He serves as one of the key advisors to the White House and U.S. Department of Health and Human Services on global AIDS issues and on initiatives to bolster medical and public health preparedness against emerging infectious disease threats such as pandemic influenza.



Mark Connors, M.D.

Chief, HIV-Specific Immunity Section, LIR

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Major Areas of Research

- Cellular immune response to HIV
- Mechanisms of immunologic control of HIV in rare patients (long-term nonprogressors or elite controllers)
- Mechanisms of broad cross-neutralization of HIV

Dr. Connors received his M.D. from Temple University and was trained in pediatrics at Tufts New England Medical Center. He joined the NIAID Laboratory of Infectious Diseases in 1989 to study the immune response to respiratory syncytial virus. He was trained in infectious diseases at the NIH Clinical Center and at the Children's Hospital of Philadelphia. He joined the NIAID Laboratory of Immunoregulation in 1994 to study the human immune response to HIV. Dr. Connors has published a series of discoveries that have laid the framework for current understanding of immunologic control of HIV in some rare patients and loss of immunologic control in the majority of HIV-infected patients.



Richard Davey, M.D.

Deputy Clinical Director, NIAID

Chief, Clinical Research Section, LIR

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Dr. Davey received his M.D. from Columbia University and trained in internal medicine at Boston University Hospital and in infectious diseases at NIAID. He joined the NIAID intramural AIDS program in 1987.

Major Areas of Research

- Treatments for HIV infection and the consequences of those treatments
- Studies of immune function, immunodeficiency, and pathogenesis of HIV disease
- Studies of the natural history, pathogenesis, and treatment of influenza infection and other emerging infectious diseases



John H. Kehrl, M.D.

Chief, B-Cell Molecular Immunology Section, LIR

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Dr. Kehrl graduated from Wayne State Medical School, completed his medical residency in internal medicine at Yale New Haven Hospital, and held fellowships in both infectious diseases and allergy-immunology in the Laboratory of Immunoregulation (LIR). He is currently a tenured senior investigator and a member of the research officers group in the Commissioned Corps of the U.S. Public Health Service. He was appointed chief of the LIR B-Cell Molecular Immunology Section in 1993. Under his supervision, the laboratory has gained international recognition for its studies of human and murine B lymphocytes and the function and regulation of heterotrimeric G-protein signaling in lymphocytes and other cell types.

Major Areas of Research

- G-protein signaling and the role of RGS proteins
- Lymphocyte trafficking
- Cell migration
- Autophagy and inflammasomes



H. Clifford Lane, M.D.

Clinical Director, NIAID

Chief, Clinical and Molecular Retrovirology Section, LIR

www.niaid.nih.gov/labs/aboutlabs/lir/ClinicalandMolecularRetrovirology

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Major Areas of Research

- Pathogenesis of HIV infection emphasizing mechanisms of immunodeficiency
- Immunologic approaches to therapy for HIV infection

Dr. Lane received his M.D. from the University of Michigan in 1976. He then completed an internship and residency at the University of Michigan Hospital in Ann Arbor. In 1979, Dr. Lane came to NIH as a clinical associate in the Laboratory of Immunoregulation (LIR). In 1985, he was appointed deputy clinical director of NIAID; in 1989, he became the chief of the Clinical and Molecular Retrovirology Section of LIR, a position he still holds. In 1991, Dr. Lane became clinical director of NIAID and, in 2006, became NIAID Deputy Director for Clinical Research and Special Projects. He is currently on the editorial boards of the *Journal of Acquired Immune Deficiency Syndromes* and the *American Journal of Medicine*.



Paolo Lusso, M.D., Ph.D.

Chief, Viral Pathogenesis Section, LIR

www.niaid.nih.gov/labs/aboutlabs/lir/viralpathogenesis/pages/lusso.aspx

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Major Areas of Research

- Pathogenesis of human viral diseases, with particular focus on HIV-1 and T-lymphotropic herpesviruses
- Viral receptors and coreceptors
- Role of chemokines and other endogenous factors in HIV-1 disease
- Characterization of highly conserved functional regions of the HIV-1 envelope as potential vaccine targets
- Novel approaches to the development of HIV-1 entry inhibitors

Dr. Lusso received his M.D. from the University of Turin and his Ph.D. from the Ministry of Scientific and Technologic Research in Rome. He is a board-certified specialist in internal medicine and in infectious diseases. He came to NIH in 1986 to work in the Laboratory of Tumor Cell Biology under Dr. Robert C. Gallo at the National Cancer Institute. He returned to Italy in 1994, where he created the Laboratory of Human Virology at the San Raffaele Scientific Institute in Milan and became associate professor of infectious diseases at the University of Cagliari. In 2006, he again joined NIH, where he became chief of the Viral Pathogenesis Section in the NIAID Laboratory of Immunoregulation. He is an executive editor of *Current HIV Research*. In 2004, he was elected as a member of the European Molecular Biology Organization.



Thomas C. Quinn, M.D., M.Sc.

Chief, International HIV/STD Section, LIR

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Dr. Quinn obtained his M.D. from Northwestern University. He was a research associate in infectious diseases in the NIAID Laboratory of Parasitic Diseases and completed a fellowship in infectious diseases at the University of Washington. Since 1981, he has been assigned to the Division of Infectious Diseases at Johns Hopkins University, where he became a professor of medicine in 1991. Dr. Quinn is a member of the Institute of Medicine and the National Academy of Sciences and is a fellow of the American Association for the Advancement of Science.

Major Areas of Research

- Definition of epidemiologic features of HIV-1 and HIV-2 infections in developing countries and the United States
- Assessment of biomedical interventions to control HIV
- Assessment of the frequency of *Chlamydia trachomatis* infections using noninvasive sensitive nucleic-acid amplification assays
- Evaluations of interventions to control blinding trachoma in sub-Saharan Africa



Steven J. Reynolds, M.D., M.P.H.

Senior Clinician, International HIV/STD Section, LIR

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Dr. Reynolds received his M.D. from McGill University in 1994 and was certified by the Royal College of Physicians and Surgeons of Canada in medical microbiology and infectious diseases in 2000. He completed his M.P.H. at Johns Hopkins University in 2002 and joined NIAID in 2003, when was posted full-time to the U.S. embassy in Kampala, Uganda. He has lived in Uganda since 2003, where he oversees clinical and laboratory research activities for the NIAID International Centers for Excellence in Research Program. In addition to his research activities, he provides HIV care and treatment at both the Rakai Health Sciences Program and the Infectious Diseases Institute in Kampala.

Major Areas of Research

- Understanding the impact of antiretroviral therapy on both rural and urban populations in Uganda
- Developing optimal laboratory monitoring strategies to improve treatment outcomes of patients receiving antiretroviral treatment
- Conducting clinical trials to delay HIV disease progression among individuals co-infected with HIV and herpes simplex virus-2
- Investigating the etiology of accelerated liver fibrosis among HIV-infected individuals in Uganda

**Irimi Sereti, M.D.**

Chief, HIV Pathogenesis Unit, LIR

www.niaid.nih.gov/labs/aboutlabs/lir/HIVPathogenesis/Pages/sereti.aspx

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Major Areas of Research

- Pathogenesis of HIV infection emphasizing mechanisms of immune reconstitution in advanced HIV infection
- Pathogenesis of idiopathic CD4 lymphocytopenia (ICL)
- Immune-based therapeutic strategies of HIV infection and ICL

Dr. Sereti received her M.D. from the University of Athens, Greece, in 1991. She did research for one year in Dr. Greg Spear's laboratory at Rush Presbyterian Hospital in Chicago and then completed an internship, residency, and chief residency in medicine at Northwestern University. In 1997, Dr. Sereti came to NIH as a clinical associate in the Laboratory of Immunoregulation. She became a staff clinician in 2003. She was appointed to a clinical tenure-track position in 2009.



Laboratory of Infectious Diseases

Jeffrey I. Cohen, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lid
301-496-5265

Sections and Units

Medical Virology Section
Jeffrey I. Cohen, M.D.

RNA Viruses Section
Peter L. Collins, Ph.D.

Hepatic Pathogenesis Section
Patrizia Farci, M.D.

Caliciviruses Section
Kim Y. Green, Ph.D.

Rotavirus Molecular Biology Section
John T. Patton, Ph.D.

Neurotropic Flaviviruses Section
Alexander G. Pletnev, Ph.D.

Emerging Respiratory Viruses Section
Kanta Subbarao, M.B.B.S., M.P.H.

Viral Pathogenesis and Evolution Section
Jeffery K. Taubenberger, M.D., Ph.D.

Research Activities

Established in 1942, the Laboratory of Infectious Diseases (LID) has a long history of vaccine development and identification of new agents of viral diseases. LID is noted for undertaking high-risk, high-reward programs that require extraordinary time and resource commitments, such as programs to develop vaccines for viral hepatitis, severe childhood respiratory diseases, and viral gastroenteritis.

Clinical studies complement LID research, including the evaluation of candidate vaccines in clinical trials, human studies of influenza pathogenesis and immune correlates for protection against the virus, and research on severe virus infections in people without known immune deficiency. Specific areas of investigation include the following:

- Vaccines for respiratory viruses, gastrointestinal viruses, hepatitis C, flaviviruses, and herpesviruses
- Pathogenesis of and host immune response to viral infections
- Microarray analysis of liver biopsies and central nervous system tissue to study host responses to viral hepatitis and neurotropic flaviviruses, respectively
- New antiviral agents
- Monoclonal antibodies to emerging and select agents
- Pandemic, seasonal, and animal influenza
- Evolution of norovirus, rotavirus, and influenza
- Identification of herpesvirus receptors
- Paramyxovirus vectors
- Virus discovery



Jeffrey I. Cohen, M.D.

Chief, Laboratory of Infectious Diseases

Chief, Medical Virology Section, LID

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Dr. Cohen received his M.D. from Johns Hopkins University and was a resident in medicine at Duke University. Following a medical staff fellowship at NIH, he was a clinical fellow in infectious diseases at the Brigham and Women's Hospital in Boston and an instructor in medicine at Harvard University. He returned to NIH, where he was the chief of the Medical Virology Section in the Laboratory of Clinical Infectious Diseases. In June 2010, Dr. Cohen became chief of the Laboratory of Infectious Diseases.

Major Areas of Research

- Pathogenesis of human virus infections *in vitro* and *in vivo*
- Identification of cellular proteins that interact with herpesviruses
- Development of vaccines against human herpesviruses
- Studies of new compounds to inhibit herpesvirus infections



Peter L. Collins, Ph.D.

Chief, RNA Viruses Section, LID

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pcollins@niaid.nih.gov

Dr. Collins received a Ph.D. in 1981 from the University of Connecticut. He conducted postdoctoral research at the University of North Carolina from 1981 to 1984. He later joined the Laboratory of Infectious Diseases, where he received tenure in 1990. He serves on the editorial boards of the *Journal of Virology*, *Virology*, and *Virus Research*.

Major Areas of Research

- Molecular biology, immunobiology, and pathogenesis of human respiratory pathogens
- Development of novel attenuating mutations that are introduced by reverse genetics into RSV; HPIV1, 2, and 3; and HMPV to produce live, attenuated vaccine candidates
- Evaluation of candidate live vaccines in clinical studies with collaborators
- Studies with mutants of pneumonia virus of mice to characterize viral infection and host responses
- Development of vaccine vectors based on HPIV and avian paramyxoviruses for use against highly pathogenic emerging viruses



Patrizia Farci, M.D.

Chief, Hepatic Pathogenesis Section, LID

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Dr. Farci earned her M.D. at the University of Cagliari Medical School, Italy, and then became a board-certified specialist in infectious diseases and gastroenterology at the same university. She was trained at the department of gastroenterology of the Molinette Hospital in Torino under Dr. Mario Rizzetto and at the department of medicine of the Royal Free Hospital School of Medicine in London under Professor Sheila Sherlock. In 1989, she joined the laboratory of Dr. Robert H. Purcell as a visiting scientist. In 1992, she became associate professor of medicine and, in 2000, full professor of medicine and director of the liver unit and of the postgraduate school of gastroenterology at the University of Cagliari. In 2007, she returned to LID, where in 2010 she became chief of the Hepatic Pathogenesis Section.

Major Areas of Research

- Pathogenesis of acute and chronic viral hepatitis
- Molecular mechanisms of liver fibrosis progression and regression
- Role of liver cirrhosis in the pathogenesis of hepatocellular carcinoma
- Role of neutralizing antibodies in the prevention and control of hepatitis C virus (HCV) infection
- HCV evolution and clinical outcome
- Search for new hepatitis agents



Kim Y. Green, Ph.D.

Chief, Calciviruses Section, LID

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kgreen@niaid.nih.gov

Dr. Green earned her Ph.D. from the University of Tennessee Center for Health Sciences in Memphis. She joined the NIAID Laboratory of Infectious Diseases in 1986 and has focused on the study of viruses associated with gastroenteritis. In recent years, her research program has addressed the role of noroviruses in human disease, with an emphasis on the development of prevention and control strategies.

Major Areas of Research

- Molecular epidemiology
- Animal models of norovirus disease
- Vaccines and antiviral inhibitors
- Basic replication mechanisms of noroviruses and other calciviruses



John T. Patton, Ph.D.

Chief, Rotavirus Molecular Biology Section, LID

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Major Areas of Research

- Structures, functions, and interactions of viral proteins involved in rotavirus (RV) genome packaging and replication
- How RVs antagonize host cell interferon responses
- Diversity and evolutionary dynamics of circulating human RVs
- Reverse-genetic strategies to aid studies of RV biology and to create live, attenuated vaccine candidates

Dr. Patton received his Ph.D. in 1980 from Virginia Polytechnic Institute and State University. Following postdoctoral training at the University of North Carolina, he joined the faculty of the University of South Florida. In 1987, Dr. Patton moved to the University of Miami School of Medicine, where he remained until 1996, when he took a position in the NIAID Laboratory of Infectious Diseases.



Alexander G. Pletnev, Ph.D., D.Sc.

Chief, Neurotropic Flaviviruses Section, LID

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apletnev@niaid.nih.gov

Major Areas of Research

- Study of pathogenesis of flavivirus infection in the central nervous system
- Development of novel approaches to restrict flavivirus neurotropism
- Generation of attenuated vaccine candidates against disease caused by highly virulent neurotropic flaviviruses and evaluation of their safety, immunogenicity, and efficacy in animal models
- Evaluation of safety and immunogenicity of live, attenuated vaccine candidates in clinical trials

Dr. Pletnev earned his Ph.D. in chemistry in 1983 from the Russian Academy of Sciences, studying RNA polymerases. Following postdoctoral research at the Novosibirsk Institute of Bioorganic Chemistry, he served as chief of its laboratory of radiochemistry and laboratory of molecular virology from 1984 to 1993. He became a professor of molecular biology in 1993. In 1990, he received his doctorate of sciences degree in biochemistry and molecular biology from the Russian Academy of Sciences. He joined the Laboratory of Infectious Diseases in 1993 as a visiting scientist and became a senior investigator in 2005.



Kanta Subbarao, M.B.B.S., M.P.H.

Chief, Emerging Respiratory Viruses Section, LID

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Dr. Subbarao received her M.B.B.S. in 1982 from the Christian Medical College, Vellore, University of Madras, India, and completed a residency in pediatrics at Cardinal Glennon Memorial Hospital for Children at St. Louis University. She completed a fellowship in pediatric infectious diseases and earned her M.P.H. in epidemiology from the University of Oklahoma Health Sciences Center. After postdoctoral training in the Laboratory of Infectious Diseases (LID), she served on the faculty at McGill University, Montreal, and subsequently served as chief of the molecular genetics section of the influenza branch at the CDC. Dr. Subbarao joined LID as a senior investigator in 2002.

Major Areas of Research

- Identification and prioritization of potential pandemic strains of influenza to target for vaccine development
- Generation of attenuated vaccine viruses by reassortment or plasmid-based reverse genetics
- Evaluation of candidate vaccine viruses in animal models
- Clinical evaluation of suitable candidate vaccines to establish safety, immunogenicity, and infectivity of live, attenuated vaccines



Jeffery K. Taubenberger, M.D., Ph.D.

Chief, Viral Pathogenesis and Evolution Section, LID

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Dr. Taubenberger received a B.S. in biology from George Mason University in 1982. He earned his medical degree in 1986 and his Ph.D. in 1987, both from the Medical College of Virginia. He completed a residency in pathology at the National Cancer Institute and holds dual board certifications in anatomic pathology and in molecular genetic pathology from the American Board of Pathology and the American Board of Medical Genetics. Prior to coming to NIAID in 2006, he served as chair of the department of molecular pathology at the Armed Forces Institute of Pathology in Washington, DC, a position he had held since 1994. Dr. Taubenberger's research interests include influenza virus biology, evolution, pathophysiology, and surveillance. He also has clinical interests in the development and implementation of molecular diagnostic assays for neoplasia and infectious diseases.

Major Areas of Research

- Influenza pathogenesis
- Animal models of influenza infection
- Influenza virus genomics and evolution
- Viral surveillance
- Archaeovirology
- Influenza diagnostics
- Clinical influenza research

Laboratory of Intracellular Parasites

Harlan D. Caldwell, Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/licp
406-363-9333

Sections and Units

Chlamydial Pathogenesis Section
Harlan D. Caldwell, Ph.D.

Immunity to Pulmonary Pathogens Section
Catharine (Katy) Bosio, Ph.D.

Host-Parasite Interactions Section
David W. (Ted) Hackstadt, Ph.D.

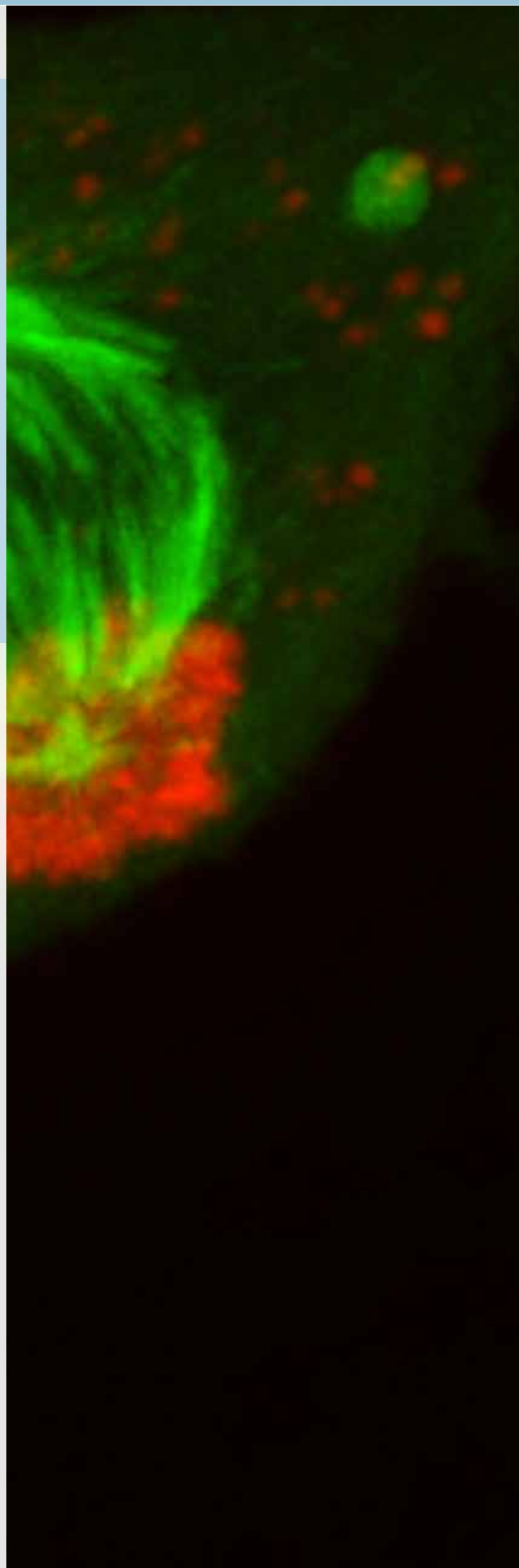
Coxiella Pathogenesis Section
Robert A. Heinzen, Ph.D.

Salmonella Host-Cell Interaction Section
Olivia Steele-Mortimer, Ph.D.

Research Activities

The Laboratory of Intracellular Parasites (LICP) investigates the biology, pathogenesis, and immunity of intracellular prokaryotic pathogens such as *Chlamydia trachomatis*, *Chlamydia pneumoniae*, *Francisella tularensis*, *Coxiella burnetii*, and *Salmonella typhimurium*. These agents are important causes of sexually transmitted diseases, preventable blindness, and chronic heart disease, and they are Category A and B bioterrorism agents. The long-term goal of the laboratory is the development of new and effective control strategies against infection with intracellular pathogens.

Modern biological, molecular, and immunological tools are employed to understand pathogen ligand-receptor interactions, pathogen vesicle maturation and trafficking, parasite manipulation of host-cell signal-transduction pathways, and host immune response to infection. Pathogen and host gene expression are being analyzed at the transcriptome and proteome levels under experimental conditions that manifest both acute and persistent infection environments to profile novel genes that function in the pathogenesis of infection. Animal models of infection are being used to define immune effector mechanisms that function in adaptive immunity and to test promising vaccine candidates.





Harlan D. Caldwell, Ph.D.

Chief, Laboratory of Intracellular Parasites

Chief, Chlamydial Pathogenesis Section, LICP

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Dr. Caldwell received his Ph.D. in pathobiology from the University of Washington in 1976. After completing a senior research fellowship in the department of medicine at the University of Washington in 1978, Dr. Caldwell joined the faculty of the University of California, San Francisco, as an assistant professor of microbiology and immunology. In 1980, he was recruited to NIH as a tenure-track investigator in the Laboratory of Microbial Structure and Function. He became a tenured investigator in 1986 and chief of the Laboratory of Intracellular Parasites in 1990. He is a recipient of the NIH Director's Award, NIH Merit Award, and PHS Superior Service Award. He was appointed to the NIH Senior Biomedical Research Service in 1997. Dr. Caldwell is a member of the editorial board of *Infection and Immunity* and a fellow of the American Academy of Microbiology. He is an internationally recognized leader in the fields of chlamydial pathogenesis and immunology.

Major Areas of Research

- Immunity to chlamydial infection
- Chlamydia vaccine design



Catharine (Katy) Bosio, Ph.D.

Chief, Immunity to Pulmonary Pathogens Section, LICP

www.niaid.nih.gov/labs/aboutlabs/licp/immunitypulmonarypathogens

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Dr. Bosio graduated from Washington State University cum laude with a B.Sc. in 1993. Following completion of her Ph.D. at Colorado State University in 1998, Dr. Bosio completed postdoctoral fellowships at the FDA Center for Biologics Evaluation and Research and at the U.S. Army Medical Research Institute for Infectious Diseases, studying innate immunity to *Mycobacterium tuberculosis*, *Francisella tularensis*, Marburg virus, and Ebola virus. Prior to joining NIAID in 2007, Dr. Bosio was an assistant professor at Colorado State University in the department of microbiology, immunology, and pathology. Dr. Bosio's laboratory studies the host response to pulmonary pathogens, with special emphasis on virulent *F. tularensis* and dendritic cells, macrophages, and monocytes.

Major Areas of Research

- Innate immunity to *F. tularensis*
- Vaccine development for pneumonic tularemia
- Modulation of human cells by *F. tularensis*



David W. (Ted) Hackstadt, Ph.D.

Chief, Host-Parasite Interactions Section, LICP

[www.niaid.nih.gov/labs/aboutlabs/licp/
hostParasiteInteractionsSection](http://www.niaid.nih.gov/labs/aboutlabs/licp/hostParasiteInteractionsSection)

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Major Areas of Research

- Chlamydia interactions with host cells
- Vesicle trafficking pathways
- Biology of *Rickettsia*

Dr. Hackstadt received his Ph.D. from Washington State University. He did his postdoctoral work in the NIAID Laboratory of Microbial Structure and Function. Dr. Hackstadt then assumed an associate professorship in the departments of pathology and microbiology at the University of Texas Medical School in Galveston. In 1990, he returned to NIAID, where he was appointed chief of the Host-Parasite Interactions Section, awarded tenure in 1995, and appointed to the NIH Senior Biomedical Research Service in 2005. He currently serves on the editorial boards of *Traffic*, *Cellular Microbiology*, and *Infection and Immunity*. He is a past president of the American Society for Rickettsiology and was elected a fellow of the American Academy of Microbiology in 2005.



Robert A. Heinzen, Ph.D.

Chief, Coxiella Pathogenesis Section, LICP

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coxiellaPathogenesisSection](http://www.niaid.nih.gov/labs/aboutlabs/licp/coxiellaPathogenesisSection)

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Major Areas of Research

- Genomics and genetic systems
- Developmental biology
- Host interactions

Dr. Heinzen received his Ph.D. in microbiology from Washington State University in 1991. After completing an Intramural Research Training Award fellowship in the NIAID Laboratory of Intracellular Parasites (LICP) in 1996, Dr. Heinzen joined the faculty of the molecular biology department at the University of Wyoming, where he was awarded tenure in 2002. Dr. Heinzen was recruited to NIAID in 2003 as head of the new Coxiella Pathogenesis Section in LICP, where he was awarded tenure in 2010 and promoted to senior investigator. Dr. Heinzen has served on the executive council for the American Society for Rickettsiology. In 2011, he was elected fellow of the American Academy of Microbiology in recognition of his studies on *Coxiella* and *Rickettsia* pathogenesis.



Olivia Steele-Mortimer, Ph.D.

Chief, Salmonella Host-Cell Interaction Section, LICP

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Dr. Steele-Mortimer received her Ph.D. in cell biology from the European Molecular Biology Laboratory in 1994. From 1995 to 1999, she did postdoctoral research on *Salmonella*-host cell interactions in the laboratory of Dr. B. Brett Finlay at the University of British Columbia, followed by one year at Washington University, St. Louis, with Dr. Phillip D. Stahl. She came to NIH in 2001 and became a tenured senior investigator in 2007. Dr. Steele-Mortimer is an associate editor of *Microbial Pathogenesis* and is a member of the editorial board of *Traffic*.

Major Areas of Research

- Host-cell proteins involved in invasion
- Biogenesis of the *Salmonella*-containing vacuole

Laboratory of Malaria and Vector Research

Thomas E. Wellems, M.D., Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lmvr
301-402-1274

Sections and Units

Malaria Genetics Section

Thomas E. Wellems, M.D., Ph.D.

Mosquito Immunity and Vector Competence Section

Carolina V. Barillas-Mury, M.D., Ph.D.

Apicomplexan Molecular Physiology Section

Sanjay Desai, M.D., Ph.D.

Malaria Pathogenesis and Human Immunity Unit

Rick M. Fairhurst, M.D., Ph.D.

International Studies of Malaria and

Entomology Section

Robert W. Gwadz, Ph.D.

Malaria Immunology Section

Carole A. Long, Ph.D.

Malaria Cell Biology Section

Louis H. Miller, M.D.

Vector Biology Section

José Ribeiro, M.D., Ph.D.

Malaria Functional Genomics Section

Xin-zhuan Su, Ph.D.

Vector Molecular Biology Section

Jesus G. Valenzuela, Ph.D.

Research Activities

The Laboratory of Malaria and Vector Research (LMVR) is dedicated to studies of malaria and insect vectors of infectious diseases. Research groups in the laboratory maintain an array of local and overseas activities that investigate disease-transmitting insects and broad areas of malaria biology and pathogenesis. Basic discoveries from these investigations support searches for new drug treatments, diagnostic tools, and vaccines. The LMVR environment is highly collaborative and organized to foster research teamwork by experts in various disciplines of the biological, physical, and medical sciences.



Thomas E. Wellems, M.D., Ph.D.

Chief, Laboratory of Malaria and Vector Research

Chief, Malaria Genetics Section, LMVR

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Dr. Wellems received his M.D. and Ph.D. from the University of Chicago. He completed his internal medicine residency at the Hospital of the University of Pennsylvania. He joined the NIAID Division of Intramural Research in 1984. He has directed the Malaria Genetics Section since 1991 and served as chief of the Laboratory of Malaria and Vector Research since 2002. Dr. Wellems is a member of the U.S. National Academy of Sciences and the Institute of Medicine. He is a past president of the American Society of Tropical Medicine and Hygiene and serves on a number of advisory committees for foundations and public-private partnerships, including the Medicines for Malaria Venture.

Major Areas of Research

- Antimalarial drug responses and factors that affect clinical outcomes after treatment
- Malaria protection conferred by human hemoglobinopathies and red blood cell polymorphisms
- Antigenic variation by *Plasmodium falciparum* parasites
- Molecular mechanisms of malaria parasite infectivity and pathogenesis



Carolina V. Barillas-Mury, M.D., Ph.D.

Chief, Mosquito Immunity and Vector Competence Section, LMVR

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Dr. Barillas-Mury received her B.S. in biology from the Universidad del Valle de Guatemala in 1981, her M.D. from Universidad Francisco Marroquín de Guatemala in 1985, and her Ph.D. in biochemistry from the University of Arizona in 1992. From 1992 to 1993, she did postdoctoral training at the University of Arizona. She then went to Harvard University in 1994 and the European Molecular Lab until 1998. She was an assistant professor in the department of microbiology, immunology, and pathology at Colorado State University from 1998 to 2003. She joined the Laboratory of Malaria and Vector Research in 2003 and became a senior investigator in 2010.

Major Areas of Research

- Interactions between *Plasmodium* parasites, the gut microbiota, and mosquito midgut epithelial cells
- Immune pathways that mediate antiplasmodial responses
- Hemocyte differentiation and immune memory in mosquitoes
- *Plasmodium* evasion of the mosquito immune system



Sanjay A. Desai, M.D., Ph.D.

Chief, Apicomplexan Molecular Physiology Section, LMVR

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Major Areas of Research

- Unusual parasite ion channels, such as the plasmodial surface anion channel (PSAC), required for parasite survival within human erythrocytes
- Identification of PSAC's gene(s) with molecular, genetic, and biochemical approaches
- Characterization of PSAC's functional properties
- Novel, high-affinity PSAC antagonists that may be targets for new antimalarial drugs

Dr. Desai received his M.D. and Ph.D. from Washington University in St. Louis. Following an internal medicine residency and infectious diseases fellowship at Duke University Medical Center, he joined NIAID's Division of Intramural Research. His work focuses on the molecular and cellular biology of malaria parasites.



Rick M. Fairhurst, M.D., Ph.D.

Chief, Malaria Pathogenesis and Human Immunity Unit, LMVR

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Major Areas of Research

- Mechanisms of malaria protection conferred by red blood cell polymorphisms and naturally acquired immune responses
- Mechanisms of malaria pathogenesis associated with the sequestration of parasitized red blood cells in host microvessels
- Mechanisms of malaria parasite resistance to artemisinin and other antimalarial drugs

Dr. Fairhurst received his M.D. and Ph.D. in molecular biology from the University of California, Los Angeles (UCLA). Following an internal medicine residency and an infectious diseases fellowship at UCLA Medical Center, he joined NIAID's Division of Intramural Research in 2001. Dr. Fairhurst focuses his laboratory's work on elucidating the mechanisms of malaria pathogenesis, human genetic resistance to malaria, acquired immunity to malaria, and parasite resistance to the artemisinin class of antimalarial drugs. He travels frequently to malaria-endemic areas of Mali and Cambodia. Dr. Fairhurst serves as president of the American Committee on Molecular, Cellular, and Immunoparasitology, a subcommittee of the American Society of Tropical Medicine and Hygiene. Recently, he was appointed deputy director of the NIH M.D.-Ph.D. Partnership Training Program. In 2011, Dr. Fairhurst received NIAID's Outstanding Mentor of the Year Award.



Robert W. Gwadz, Ph.D.

Chief, International Studies of Malaria and Entomology Section, LMVR

www.niaid.nih.gov/labs/aboutlabs/lmvr/internationalstudiesmalariaentomologysection

rgwadz@niaid.nih.gov

Dr. Gwadz received his Ph.D. from the University of Notre Dame in 1970 for studies on the reproductive physiology of mosquitoes. He was a postdoctoral fellow in tropical public health at the Harvard University School of Public Health before joining NIH in 1972. He served as head of the Medical Entomology Program in the NIAID Laboratory of Parasitic Diseases until 1995. In the Laboratory of Malaria and Vector Research (LMVR), he is responsible for the development and operation of the Malaria Research and Training Center in Bamako, Mali, and the new LMVR malaria research program in Cambodia. In recognition of his work in establishing a program of cooperative research on vector-borne diseases in the Middle East, Dr. Gwadz was named an Honorary Fellow of the Hebrew University of Jerusalem, an Honorary Member of the Board of the Ain Shams University (Cairo) Center for Study of Tropical Diseases, and an Honorary Fellow of the Egyptian Society of Parasitologists.

Major Areas of Research

- Antimalarial drugs
- Malaria vaccines
- Vector biology and malaria transmission
- Training opportunities in Africa and Cambodia



Carole A. Long, Ph.D.

Chief, Malaria Immunology Section, LMVR

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Dr. Long received her B.A. from Cornell University and her Ph.D. in microbiology and immunology from the University of Pennsylvania. She completed postdoctoral training at the University of Pennsylvania. She was a professor of microbiology and immunology at Drexel University School of Medicine in Philadelphia, teaching medical and graduate students and conducting research on malaria parasites. The goal of her section is to provide a detailed picture of innate and adaptive humoral and cellular immune responses to blood stages of malaria parasites and to apply these insights to new vaccine approaches to the disease.

Major Areas of Research

- Mechanisms responsible for the acquisition of immunity to malaria parasites in Malian children
- Immune responses to malaria blood-stage antigens in those living in malaria-endemic areas
- Comparing malaria-specific immune responses of Malian children to defined red blood cell polymorphisms
- Development of standardized assays to evaluate antibodies to various blood-stage and sexual-stage malaria parasite proteins
- Use of proteomic approaches and aptamer technology to search for novel vaccine candidates



Louis H. Miller, M.D.

Chief, Malaria Cell Biology Section, LMVR

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Major Areas of Research

- Mechanism by which malaria parasites invade erythrocytes (including the study of parasite ligands and erythrocyte receptors)
- Mechanism of antigenic variation
- Molecular basis for cerebral malaria

Dr. Miller received his B.S. from Haverford College in Pennsylvania, his M.S. from Columbia University, and his M.D. from Washington University in St. Louis. He then served as a medical resident at Montifiore Hospital, New York, and as an intern and resident at Mount Sinai Hospital. He is a member of the Association of American Physicians, American Society of Clinical Investigation, American Society of Tropical Medicine and Hygiene (ASTMH), Royal Society of Tropical Medicine and Hygiene, National Academy of Sciences, and the Institute of Medicine. In 2011, he received the ASTMH Walter Reed Medal for distinguished accomplishment in the field of tropical medicine.



José M.C. Ribeiro, M.D., Ph.D.

Chief, Vector Biology Section, LMVR

www.niaid.nih.gov/labs/aboutlabs/lmvr/vectorBiologySection

jribeiro@niaid.nih.gov

Major Areas of Research

- Role of vector saliva in blood feeding by arthropods
- Discovery and determination of mode of action of novel anti-clotting, anti-platelet, immunomodulatory, and vasodilatory agents
- Expression of novel proteins and peptides with known and unknown function
- Development of tools for transcriptome annotation

Dr. Ribeiro received his M.D. from the State University of Rio de Janeiro and his Ph.D. from the Biophysics Institute of the Federal University of Rio de Janeiro. He was an assistant and associate professor at the Harvard School of Public Health and professor in the department of entomology at the University of Arizona before joining NIAID in 1996. His work focuses on the role of vector saliva in blood feeding by arthropods, where a great diversity of pharmacologically active compounds and new targets for vaccination against vector-borne diseases have been uncovered. Dr. Ribeiro has served for many years in the Tropical Diseases Research Program of the World Health Organization and as editor and reviewer for several journals.



Xin-zhuan Su, Ph.D.

Chief, Malaria Functional Genomics Section, LMVR

www.niaid.nih.gov/labs/aboutlabs/lmvr/malariafunctionalgenomicssection

xsu@niaid.nih.gov

Dr. Su received his Ph.D. in parasitology from the University of Georgia in 1990. He joined NIAID's Laboratory of Parasitic Diseases in 1992 and became an investigator in the Laboratory of Malaria and Vector Research in 2001. He became a senior investigator in 2006.

Major Areas of Research

- *Plasmodium* genetics and genomics
- Mechanisms of antimalarial drug resistance and virulence
- *Plasmodium* gene regulation and expression



Jesus G. Valenzuela, Ph.D.

Chief, Vector Molecular Biology Section, LMVR

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Dr. Valenzuela received his Ph.D. in biochemistry from the University of Arizona in 1995. He joined the NIAID Laboratory of Parasitic Diseases in 1996, became a research fellow in 1999, and became a tenure-track investigator in the Laboratory of Malaria and Vector Research in October 2002. Dr. Valenzuela became a senior investigator in October 2009.

Major Areas of Research

- Functional transcriptomic approaches to characterizing vector salivary proteins
- Development of natural models of leishmaniasis to study the impact of immune responses to sand fly salivary proteins in parasite transmission, early events of pathogenesis, and adaptive immunity
- Human cellular immune responses to sand fly salivary proteins in volunteers and people living in leishmaniasis-endemic areas
- Development of biomarkers for vector exposure using immunogenic salivary proteins

**Laboratory of Malaria
Immunology and Vaccinology****Patrick E. Duffy, M.D., Chief**

www.niaid.nih.gov/labs/aboutlabs/lmiv
301-443-4605

Sections and Units

Vaccine Development Unit, Pathogenesis and
Immunity Section

Patrick Duffy, M.D.

Molecular Pathogenesis and Biomarkers Section

Michal Fried, Ph.D.

Human Immune Regulation Section

Michael Walther, Ph.D., M.Sc.

Research Activities

The Laboratory of Malaria Immunology and Vaccinology (LMIV) was commissioned in 2009 to conduct basic and applied research relevant to malaria immunology and vaccine development, to pursue novel vaccine concepts, to produce prototype malaria vaccines, and to conduct early-phase clinical trials of promising vaccine candidates. Our overarching goal is to develop malaria vaccines that will reduce severe disease and death among African children and pregnant women and will eliminate malaria from low-transmission areas of the world.

LMIV has an organizational structure that encompasses both basic discovery and product development within a small, integrated team. Discovery sections within LMIV conduct basic research on malaria pathogenesis and immunology, with an emphasis on studies in humans who are naturally or experimentally infected with malaria parasites. In parallel, the Vaccine Development Unit conducts a variety of activities, including antigen selection and preclinical studies that move multiple vaccine candidates from concept to clinical trials efficiently and rapidly. Together, the discovery sections and development unit form a research and testing enterprise that can rapidly translate ideas into proof of concept trials and then capture basic information about human immunity and responses to infection during human clinical trials. Objectives of the lab are as follows:

- Enhance our basic understanding of malaria pathogenesis and immunity in humans
- Develop strategies for anti-infection, anti-disease, and transmission-blocking vaccines
- Produce and formulate antigens suitable for human testing
- Develop assays and perform animal trials that define the potential for protection
- Conduct clinical trials to test vaccines in the United States and in malaria-endemic areas



Patrick E. Duffy, M.D.

Chief, Laboratory of Malaria Immunology and Vaccinology

Chief, Pathogenesis and Immunity Section, LMIV

Chief, Vaccine Development Unit, LMIV

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Dr. Duffy is chief of the Laboratory of Malaria Immunology and Vaccinology. Before taking this position in November 2009, he served as malaria program director at Seattle Biomedical Research Institute (SBRI) and affiliate professor of global health at the University of Washington. His research is focused on understanding the pathogenesis and immunology of malaria in humans. He leads the Pregnancy Malaria Initiative to develop a malaria vaccine for pregnant women, a Grand Challenges in Global Health consortium project to understand immunity to severe malaria in African children, and a consortium of laboratories identifying novel vaccine targets against liver-stage malaria parasites. He recently established the Malaria Clinical Trials Center for experimental malaria infections of humans in Seattle and for several years led the SBRI-Tanzania Malaria Research Training Program for young African scientists. He received his medical degree from Duke University, his internal medicine training at Walter Reed, and his postdoctoral training in molecular vaccine development at NIH.

Major Areas of Research

- Pregnancy malaria: conserved surface antigens and mechanisms of disease
- Liver-stage malaria: antigen discovery and models of immunity
- Severe malaria in children: epidemiology and pathogenesis
- Process development of vaccine candidates for commercial viability
- Preclinical evaluation of vaccine candidates
- Clinical trials in the United States and abroad
- Immunologic assay development



Michal Fried, Ph.D.

Chief, Molecular Pathogenesis and Biomarkers Section, LMIV

www.niaid.nih.gov/labs/aboutlabs/lmiv/pages/molpathogenesibiomarkers.aspx

friedm@mail.nih.gov

Dr. Fried earned her Ph.D. in molecular parasitology at Hebrew University (Israel) and M.Sc. in biochemistry at Ben-Gurion University. She has performed groundbreaking work on the molecular basis of placental malaria and described the model of protective immunity that is the basis of the current effort to develop a pregnancy malaria vaccine. The model of pregnancy malaria has been expanded to longitudinal studies of severe malaria in African children.

Major Areas of Research

- Correlates of immunity: parasite adhesion phenotypes, parasite antigens, and antigen-specific antibodies
- Disease biomarkers: pathway analysis of host response and disease comparison
- Identifying targets of pre-erythrocytic immunity

**Michael Walther, Ph.D., M.Sc.**

Chief, Human Immune Regulation Section, LMIV

www.niaid.nih.gov/labs/aboutlabs/lmiv/pages/humanimmunereg.aspx

waltherrc@mail.nih.gov

Major Areas of Research

- Role of immune regulatory components induced by malaria in the outcome of subsequent malaria infections, using samples from field studies
- Induction requirements of malaria-induced immune regulatory components *in vitro*
- Clinical testing of adjunctive treatment for severe malaria

Dr. Walther joined the Laboratory of Malaria Immunology and Vaccinology in 2010 as chief of the Human Immune Regulation Section. Prior to this position, he was senior immunologist at the Malaria Research Program of the UK Medical Research Council laboratories in The Gambia. His education includes medical training at the University of Bonn, Germany, with specializations in general medicine, tropical medicine, and emergency medicine; an M.Sc. in tropical medicine and international health from the London School of Hygiene and Tropical Medicine; and a Ph.D. and the *venia legendi* in tropical medicine and infectious disease immunology (equivalent to an associate professorship) from the University of Bonn.

Laboratory of Molecular Immunology

Philip M. Murphy, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lmi
301-496-8616

Sections and Units

Molecular Signaling Section
Philip M. Murphy, M.D.

Inflammation Biology Section
Joshua M. Farber, M.D.

Mucosal Immunobiology Section
Brian L. Kelsall, M.D.

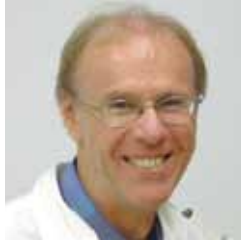
Immune Activation Section
Ulrich K. Siebenlist, Ph.D.

Research Activities

The Laboratory of Molecular Immunology (LMI) studies innate and adaptive immune system function in health and disease and is especially interested in delineating mechanisms that control specific leukocyte movement. A major focus at the molecular level is the chemokines and other chemoattractants and their G protein-coupled receptors.

LMI scientists also pursue studies of mucosal immunology in the gut, reovirus and rotavirus infection, and mouse models of inflammatory bowel disease. They explore the basic properties of neutrophils, macrophages, naïve and memory T cells, and dendritic cells, as well as genetic risk factors for complex immune-mediated diseases.

In LMI, studies on the molecular pathogenesis of infectious and immunologic/inflammatory diseases, including HIV/AIDS, West Nile virus infection, *Listeria* infection, fungal infection, sepsis, atherosclerosis, psoriasis, and primary immunodeficiency, aim to identify novel therapeutic targets and vaccine strategies.



Philip M. Murphy, M.D.

Chief, Laboratory of Molecular Immunology

Chief, Molecular Signaling Section, LMI

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Major Areas of Research

- Host defense and inflammation
- G-protein-coupled chemoattractant receptors
- Genetic risk factors in infectious and immune-mediated diseases

Dr. Murphy obtained an A.B. from Princeton University in 1975 and an M.D. from Cornell University Medical College in 1981. He trained in internal medicine at New York University from 1981 to 1985, serving as chief resident from 1984 to 1985, and in infectious diseases at NIAID from 1985 to 1988. He began his research career as a medical staff fellow in the Bacterial Diseases Section of the NIAID Laboratory of Clinical Investigation in 1986 and was promoted to senior investigator with tenure in the Laboratory of Host Defenses (LHD) in 1992. In 1998, he was promoted to the Senior Biomedical Research Service and named chief of the LHD Molecular Signaling Section. In 2003, Dr. Murphy's research group was reorganized as part of the new Laboratory of Molecular Immunology, where he served first as acting chief from 2003 to 2006 and then as chief from 2006 to the present.



Joshua M. Farber, M.D.

Chief, Inflammation Biology Section, LMI

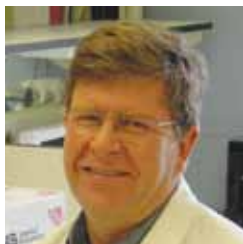
www.niaid.nih.gov/labs/aboutlabs/lmi/inflammationbiology

jfarber@niaid.nih.gov

Major Areas of Research

- Chemokines and their receptors in health and disease

Dr. Farber obtained his M.D. from Johns Hopkins University, where he did clinical training in internal medicine and infectious diseases. Dr. Farber's postdoctoral training in bench research was both at NIH and at Johns Hopkins. Dr. Farber joined the NIAID Laboratory of Clinical Investigation in 1993, became a senior investigator in 2000, and moved to the Laboratory of Molecular Immunology at its inception in 2004.



Brian L. Kelsall, M.D.

Chief, Mucosal Immunobiology Section, LMI

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bkelsall@niaid.nih.gov

Dr. Kelsall received his B.A. in human biology from Stanford University in 1982. In 1986, he earned his M.D. from Case Western Reserve University School of Medicine. He did postdoctoral training in internal medicine at the New York Hospital-Cornell Medical Center from 1986 to 1989 and in infectious diseases at the University of Virginia Medical Center from 1989 to 1992. In 1992, Dr. Kelsall came to NIH, completed fellowship training in mucosal immunology in 1996, and became a senior investigator in 2003. His research focuses on the regulation of immune responses in the intestine, in particular the role that unique intestinal dendritic cell and macrophage populations play in the induction of immunity to intestinal viral pathogens and mucosal vaccines and in the pathogenesis of inflammatory bowel disease.

Major Areas of Research

- Antigen presentation by mucosal dendritic cells and the regulation of mucosal immune responses
- Regulation of IL-12 production
- Innate and adaptive immunity to intestinal viral infection
- Genetic susceptibility to intestinal inflammation in mouse models of inflammatory bowel disease



Ulrich Siebenlist, Ph.D.

Chief, Immune Activation Section, LMI

www.niaid.nih.gov/labs/aboutlabs/lmi/immuneactivationsection

usiebenlist@niaid.nih.gov

Dr. Siebenlist received his Ph.D. at Harvard University, studying protein-DNA interactions with Nobel Laureate Dr. Walter Gilbert. As a postdoctoral fellow in Dr. Philip Leder's laboratory at both NIH and Harvard Medical School, Dr. Siebenlist studied immunoglobulin gene structures and the regulation of the myc oncogene. He then joined the NIAID Laboratory of Immunoregulation as chief of the Immune Activation Section. In 2013, his section joined the Laboratory of Molecular Immunology. Dr. Siebenlist has made many significant contributions to the present understanding of the regulation and function of NF-kappa B transcription factors, which serve as master regulators of numerous immune responses.

Major Areas of Research

- Normal functions of NF-kappa B transcription factors and their regulators
- Dysregulated functions of NF-kappa B transcription factors in disease
- Identification of factors/regulators that may serve as targets for therapeutic intervention
- Functions of the IL-17 cytokine family in host defenses
- Functions and mechanisms of action of IL-17 cytokines in specific inflammatory and autoimmune diseases
- Molecular dissection of the signaling pathways engaged by IL-17 cytokines and development of therapeutic reagents to block specific signaling paths in disease

A large vertical image on the left side of the page shows a fluorescence micrograph of cells. The cells are stained with green and red dyes, highlighting specific cellular components. The background is dark, making the green and red signals stand out. The text 'Laboratory of Molecular Microbiology' is written vertically in white on a black background to the right of this image.

Laboratory of Molecular Microbiology

Malcolm A. Martin, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lmm
301-496-4012

Sections and Units

Viral Pathogenesis and Vaccine Section

Malcolm A. Martin, M.D.

Jason M. Brenchley, Ph.D.

Viral Budding Unit

Fadila Bouamr, Ph.D.

Nonhuman Primate Virology Section

Vanessa M. Hirsch, D.V.M., D.Sc.

Viral Biology Section

Christine A. Kozak, Ph.D.

Viral Biochemistry Section

Klaus Strebel, Ph.D.

Research Activities

When it was established in 1981, the Laboratory of Molecular Microbiology (LMM) investigated the structure, function, and regulation of a diverse group of microorganisms including RNA and DNA viruses, aerobic and anaerobic bacteria, and mycoplasmas. Currently, the main focus of LMM scientists is murine and primate retroviruses, with the principal area of research activity involving HIV-1. Fundamental investigations of viral gene regulation, protein structure and function, and particle assembly are integrated with studies of the determinants of immunologic protection against HIV and viral pathogenesis. Major research areas are as follows:

- Studies of the synthesis, processing, and assembly of retroviral-encoded proteins into progeny virions
- Exploration of the structure and function relationship of retroviral accessory proteins synthesized during productive and chronic viral infections
- Understanding the regulation of retroviral gene activity and how viral encoded proteins dysregulate normal cellular processes
- Development of animal models for investigations of viral pathogenesis, the identification of potentially useful antiviral agents, and the development of protective vaccines



Malcolm A. Martin, M.D.

Chief, Laboratory of Molecular Microbiology

Chief, Viral Pathogenesis and Vaccine Section, LMM

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Dr. Martin received an M.D. from Yale University School of Medicine in 1962 and, following two years of clinical training in internal medicine at the University of Rochester, joined NIH as a research associate. He initially investigated the replication and gene regulation of SV40 and polyomaviruses and subsequently studied endogenous murine and human retroviral sequences. Since 1984, his research program has focused on HIV. Dr. Martin was appointed chief of the Laboratory of Molecular Microbiology when it was established in 1981. He is a member of the National Academy of Sciences and the recipient of numerous scientific awards.

Major Areas of Research

- Studies of primate and murine retroviral biology and genetics in cell culture systems and animal models
- Assessment of SIV and SIV/HIV chimeric virus (SHIV) acute infections in macaque monkeys
- Development of R5-tropic SHIVs as challenge viruses in vaccine experiments
- Use of R5-tropic SHIVs to investigate the development of cross-reacting, anti-HIV-1, neutralizing antibodies in virus-infected and vaccinated nonhuman primate models



Jason M. Brechley, Ph.D.

Senior Investigator, Viral Pathogenesis and Vaccine Section, LMM

www.niaid.nih.gov/labs/aboutlabs/Imm/viralpathogenesisvaccinesection/pages/brechley.aspx

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Dr. Brechley received a master's degree from Idaho State University in 1999 and received a Ph.D. from the University of Texas Southwestern Medical Center at Dallas in 2003. He joined NIH as a research fellow, studying immunopathogenesis and mucosal immunology in HIV-infected individuals. Since 2008, he has been an investigator in the Laboratory of Molecular Microbiology.

Major Areas of Research

- Immunopathogenesis in nonhuman primate models of HIV
- Microbial translocation and immune activation
- Mucosal immunology and mechanisms of microbial translocation



Fadila Bouamr, Ph.D.

Chief, Viral Budding Unit, LMM

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Major Areas of Research

- Recruitment and function of cellular factors that facilitate virus separation from cells and structure-function studies of proteins involved in these processes
- New host factors involved in virus release
- Role of ubiquitin in virus egress and membrane scission and other important cellular processes
- Virus assembly and trafficking to sites of virus budding

Dr. Fadila Bouamr received her Ph.D. from Victor Segalen Bordeaux University in 1997. She performed her postdoctoral research with Dr. Carol Carter at the State University of New York at Stony Brook and with Dr. Steve Goff at Columbia University. She joined the Laboratory of Molecular Microbiology in December 2004.



Vanessa M. Hirsch, D.V.M., D.Sc.

Chief, Nonhuman Primate Virology Section, LMM

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Major Areas of Research

- AIDS pathogenesis
- Evolution and origins of primate lentiviruses
- HIV vaccine development

Dr. Hirsch received her D.V.M. from the University of Saskatchewan in 1977 and did a residency in pathology at the same institution, becoming board-certified by the American College of Veterinary Pathologists in 1984. She earned her D.Sc. from Harvard School of Public Health in 1988. She was a research assistant professor at Georgetown University until 1992, when she joined the NIAID Laboratory of Infectious Diseases, transferring to the Laboratory of Molecular Microbiology in 1999 and becoming tenured in 2002.



Christine A. Kozak, Ph.D.

Chief, Viral Biology Section, LMM

www.niaid.nih.gov/labs/aboutlabs/lmm/viralBiologySection

ckozak@niaid.nih.gov

Dr. Kozak received her Ph.D. in biology from Yale University in 1977. After a postdoctoral fellowship at NIAID under Dr. Wallace Rowe, she joined the Laboratory of Molecular Microbiology (LMM) in 1984. In 1992, Dr. Kozak became chief of the Viral Biology Section in LMM. She is an associate editor for several journals, has served on the Committee on Standardized Nomenclature for Mice, was chair of the Mouse Chromosome 5 Committee for 10 years, and has authored more than 400 research publications on mouse retroviruses and mouse genetics.

Major Areas of Research

- Genetics of resistance to mouse retroviruses
- Naturally occurring mouse retroviruses



Klaus Strebel, Ph.D.

Chief, Viral Biochemistry Section, LMM

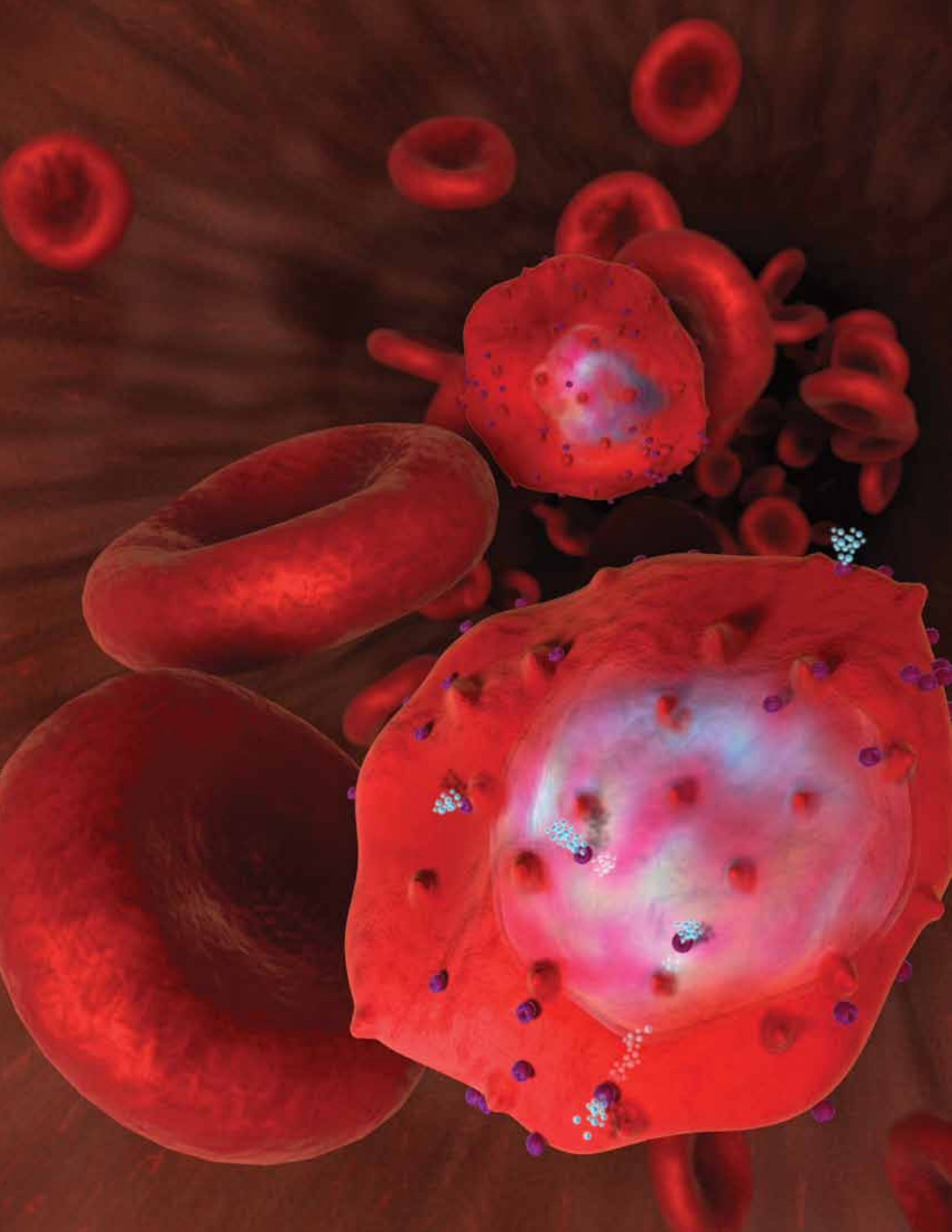
www.niaid.nih.gov/labs/aboutlabs/lmm/viralBiochemistrySection

kstrebel@niaid.nih.gov

Dr. Strebel received his Ph.D. in microbiology in 1985 from the University of Heidelberg, Germany. After postdoctoral research in Germany on foot-and-mouth disease protein processing and maturation, he joined the NIAID Laboratory of Molecular Microbiology (LMM) in 1986 as a postdoctoral fellow to work on molecular mechanisms of HIV-1 replication. He was awarded tenure in 1998 and, since 2000, has been chief of the Viral Biochemistry Section within LMM.

Major Areas of Research

- Biological and biochemical functions of HIV accessory proteins
- Characterization of cellular factors involved in Vif and Vpu function
- Characterization of innate immune defense mechanisms



Laboratory of Parasitic Diseases

Alan Sher, Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lpd
301-496-3535

Sections and Units

Immunobiology Section
Alan Sher, Ph.D.

Clinical Parasitology Section, Helminth Immunology Section
Thomas B. Nutman, M.D.

T-Lymphocyte Biology Unit
Daniel L. Barber, Ph.D.

Mucosal Immunology Section
Yasmine Belkaid, Ph.D.

Molecular Parasitology Unit
Michael Grigg, Ph.D.

Eosinophil Pathology Unit
Amy D. Klion, M.D.

Microbial Pathogenesis Section
Stephen H. Leppla, Ph.D.

Gastrointestinal Parasites Section
Theodore E. Nash, M.D.

Intracellular Parasite Biology Section
David L. Sacks, Ph.D.

Immunopathogenesis Section
Thomas A. Wynn, Ph.D.

Research Activities

The Laboratory of Parasitic Diseases (LPD) conducts basic and applied research on the prevention, control, and treatment of a variety of parasitic and bacterial diseases of global importance. The work of the group is largely directed toward the identification of immunological and molecular targets for disease intervention. The pathogens studied include parasitic protozoa, helminths, intestinal nematodes, and non-parasitic agents. Much of this work aims to uncover basic aspects of the host-pathogen interaction in both humans and experimental animal models, as well as in the invertebrate vectors that transmit medically important parasites. A common theme in many of LPD's research projects is the regulatory environment induced in chronic parasitic and bacterial infection and the identification of determinants of host resistance and pathology, with a focus on barrier sites.

LPD also includes a clinical group that conducts patient-centered research at the NIH Clinical Center and international field studies in India, Latin America, and Africa. Four new programs focus on genetic determinants of virulence in apicomplexan protozoa, the function of the eosinophil in human infectious and inflammatory disease processes, the role of commensal microbiota in immune regulation and homeostasis, and T-cell regulation in mycobacterial and fungal opportunistic infections.



Alan Sher, Ph.D.

Chief, Laboratory of Parasitic Diseases

Chief, Immunobiology Section, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/immunobiologySection

asher@niaid.nih.gov

Major Areas of Research

- Mechanisms of host resistance and immune regulation in parasitic and mycobacterial infection
- Role of innate pathogen recognition in the initiation of adaptive immunity and in CD4+ T-cell subset effector choice
- Regulatory pathways limiting pathogen-induced Th1 immunopathology
- Immunotherapeutic approaches to the treatment of infectious disease

Dr. Sher received his Ph.D. from the University of California-San Diego and did his postdoctoral training in the division of parasitology at the National Institute for Medical Research in Mill Hill, London. In 1980, after several years as a research associate and then assistant professor in the department of pathology at Harvard Medical School, he joined NIAID as a section chief in the Laboratory of Parasitic Diseases (LPD). Sher became chief of LPD in 2003 and was promoted to NIH Distinguished Investigator in 2011.



Thomas B. Nutman, M.D.

Deputy Chief, Laboratory of Parasitic Diseases

Chief, Helminth Immunology Section, LPD

Chief, Clinical Parasitology Section, LPD

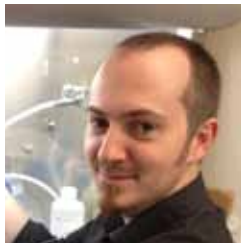
www.niaid.nih.gov/labs/aboutlabs/lpd/helminthimmunologysection

tnutman@niaid.nih.gov

Major Areas of Research

- Regulation of the host immune response to parasitic helminth infection
- Influence of helminth infection on expression of non-parasitic infections, atopy, and asthma
- Molecular characterization of tissue-invasive helminth parasites
- Clinical definition and pathogenesis underlying parasitic diseases
- Hypereosinophilic syndromes, from pathogenesis to novel therapies

Dr. Nutman received his A.B. from Brown University and his M.D. from the University of Cincinnati College of Medicine. He did an internal medicine residency at New York University (Bellevue) and postdoctoral training in the Laboratory of Parasitic Diseases (LPD). He is board-certified in internal medicine and allergy and immunology. He also holds a diploma/certificate in tropical medicine and travelers' health. He has been at LPD since 1982, where he is currently deputy chief, as well as chief of both the Helminth Immunology Section and the Clinical Parasitology Section. In addition, he is the director of the NIAID International Center for Excellence in Research (ICER) located in Chennai, India, as well as director of the filariasis unit at the NIAID ICER in Mali. He is on numerous advisory committees and editorial boards and holds patents related to parasite diagnosis and vaccine development. He is the author or coauthor of more than 400 papers and book chapters and has received multiple awards for his work in tropical medicine and immunology.



Daniel L. Barber, Ph.D.

Chief, T-Lymphocyte Biology Unit, LPD

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barberd@niaid.nih.gov

Dr. Barber obtained his B.S from Rider University and his Ph.D. from Emory University in the department of microbiology and immunology. In 2006, he joined the Laboratory of Parasitic Diseases as a postdoctoral fellow in the Immunobiology Section. In 2012, Dr. Barber was awarded a position as an Earl Stadman Tenure-Track Investigator in the Laboratory of Parasitic Diseases.

Major Areas of Research

- Immunoregulation during infection with *Mycobacterium tuberculosis* and opportunistic fungal pathogens
- Mechanisms of mycobacteria-associated immune reconstitution inflammatory syndrome
- Role of the PD-1 pathway in the regulation of T cell responses



Yasmine Belkaid, Ph.D.

Chief, Mucosal Immunology Section, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/mucosalimmunology

ybelkaid@niaid.nih.gov

Dr. Belkaid obtained her Ph.D. in 1996 from the Pasteur Institute in France on innate responses to *Leishmania* infection. In 2002, following a postdoctoral fellowship at NIAID on immune regulation during *Leishmania* infection, she joined the Children's Hospital Research Foundation in Cincinnati as an assistant professor. She joined the NIAID Laboratory of Parasitic Diseases in 2005. Since 2008, she also has served as adjunct professor at the University of Pennsylvania.

Major Areas of Research

- Role of the microbiota in immunity to infection
- Role of dietary metabolites in promoting immune regulation and immune responses to pathogens
- Tissue-specific regulatory responses to infection
- *Leishmania major*, *Toxoplasma gondii*, *Cryptosporidium*, and *Microsporidium spp*



Michael E. Grigg, Ph.D.

Chief, Molecular Parasitology Unit, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/molecularparasitologyunit

griggm@niaid.nih.gov

Major Areas of Research

- Biology and genetics of virulence shifts in protozoan parasite populations
- Forward/reverse genetics and functional genomic screens that identify protozoan parasite virulence factors
- Mechanisms of host resistance and *Toxoplasma* pathogenesis
- Structure-function and regulation analyses of parasite gene families that modulate host immunity, infectivity, and parasite transmissibility

Dr. Grigg earned his B.Sc. in 1989 from the University of British Columbia. He obtained his Ph.D. and D.I.C. in 1994 from the Imperial College of Science, Technology, and Medicine at the University of London. From 1994 to 1997, Dr. Grigg was a Howard Hughes Medical Institute senior fellow at the University of Washington. From 1997 to 2001, he trained as a postdoctoral scholar in molecular parasitology at Stanford University. In 2002, he was appointed as an assistant professor of medicine, microbiology, and immunology at the University of British Columbia. In 2006, he joined the Laboratory of Parasitic Disease as a tenure-track investigator.



Amy D. Klion, M.D.

Chief, Eosinophil Pathology Unit, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/eosinophilpathology

aklion@niaid.nih.gov

Major Areas of Research

- Identification and characterization of new subtypes of hypereosinophilic syndromes
- Elucidation of the role of the eosinophil in pathogenesis of eosinophilic disorders
- Assessment of the safety and efficacy of chemotherapeutic agents targeting eosinophils (or their precursors)
- Prevention of post-treatment reactions in loiasis

Dr. Klion earned her B.A. from Princeton University and her M.D. from New York University School of Medicine. After completing a residency in internal medicine at Johns Hopkins University, she was a postdoctoral fellow in the Laboratory of Parasitic Diseases (LPD) from 1989 to 1991. She completed her fellowship in infectious diseases at the University of Iowa Hospitals and Clinics in Iowa City, where she was appointed as an assistant professor in the division of infectious diseases. She returned to LPD in 1997 as a staff clinician. She became a tenure-track clinical investigator in 2009.



Stephen H. Leppla, Ph.D.

Chief, Microbial Pathogenesis Section, LPD

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Dr. Leppla earned a B.S. in biology from the California Institute of Technology and a Ph.D. in biochemistry from the University of Wisconsin. After postdoctoral study at the University of California-Berkeley and Brown University, he became a research scientist at the U.S. Army Medical Research Institute of Infectious Diseases. He moved to NIH in 1989 and to NIAID in 2003.

Major Areas of Research

- Structure-function relationships in bacterial protein toxins and the roles of toxins and other virulence factors in contributing to bacterial pathogenesis
- Bacterial gene regulation, interactions of bacteria and toxins with animal cells and tissues, the effects of toxins on host physiology, and the molecular mechanisms of toxin action
- Use of basic research results in the design of vaccines and therapeutics



Theodore E. Nash, M.D.

Chief, Gastrointestinal Parasites Section, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/gastrointestinalParasitesSection

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Dr. Nash received his M.D. from the University of Miami in 1968 and completed his internship and residency at Duke University. In 1970, he was appointed a fellow in the NIAID Laboratory of Clinical Investigation and, in 1973, became a staff fellow in the Laboratory of Parasitic Diseases (LPD). After an infectious disease fellowship at the Beth Israel-Children's Hospital in Boston and a fellowship in biological chemistry at Harvard University, he returned to LPD as a senior scientist in 1976.

Major Areas of Research

- Treatment of neurocysticercosis
- Natural history, disease association, morbidity, prevention, and treatment of perilesional edema episodes associated with calcific cysticercosis
- Development of model cestodes infection
- Immune response associated with treatment of acute inflammatory responses
- Antigenic variation in *Giardia*, cellular biology, and differences among *Giardia* groups/isolates



David L. Sacks, Ph.D.

Chief, Intracellular Parasite Biology Section, LPD

www.niaid.nih.gov/labs/aboutlabs/lpd/intracellularParasiteBiologySection

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Major Areas of Research

- Parasite and sand fly molecules controlling the development of transmissible infections
- Development and evaluation of candidate vaccines against leishmaniasis
- Mechanisms of acquired resistance and those controlling persistent infection
- Mechanisms underlying pathogenesis and immunosuppression in visceral leishmaniasis and development of immune-based therapies

Dr. Sacks obtained his Ph.D. from Harvard University for studies on immune responses to chlamydial infections. Following a postdoctoral fellowship at the National Institute for Medical Research in London (Mill Hill) studying immune suppression in African trypanosomiasis, he joined the Laboratory of Parasitic Diseases in 1980. He became a senior investigator in 1986.



Thomas A. Wynn, Ph.D.

Chief, Immunopathogenesis Section, LPD

Scientific Director, NIH-Oxford-Cambridge Scholars Program

www.niaid.nih.gov/labs/aboutlabs/lpd/immunopathogenesisSection

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Major Areas of Research

- Chronic inflammation and fibrosis
- Asthma
- Pulmonary fibrosis
- Liver fibrosis in schistosomiasis
- Th2 and Th17 responses in inflammatory bowel disease

Dr. Wynn obtained his Ph.D. from the University of Wisconsin-Madison Medical School in the department of microbiology and immunology. He is a member of the American Association of Immunologists and the American Society of Tropical Medicine and Hygiene. Dr. Wynn is the recipient of the Oswaldo Cruz Medal and the NIH Certificate of Merit. He joined the Laboratory of Parasitic Diseases in 1991. He became a senior investigator in 2002.

Laboratory of Persistent Viral Diseases

Bruce W. Chesebro, M.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lpvd
406-363-9354

Sections and Units

TSE/Prion and Retroviral Pathogenesis Section
Bruce W. Chesebro, M.D.

TSE/Prion Cell Biology Section
Gerald S. Baron, Ph.D.

TSE/Prion Biochemistry Section
Byron Caughey, Ph.D.

Retroviral Molecular Biology Section
Leonard H. Evans, Ph.D.

Retroviral Immunology Section
Kim J. Hasenkrug, Ph.D.

Neuroimmunology Unit
Karin Peterson, Ph.D.

TSE/Prion Molecular Biology Section
Suzette A. Priola, Ph.D.

Research Activities

The Laboratory of Persistent Viral Diseases (LPVD) studies persistent active, latent viral, and prion disease infections. Investigators place particular emphasis on persistent infections of the nervous system and of the hematopoietic and lymphoid systems. The laboratory also is studying the roles of persistent infection in the development of retrovirus-induced immunosuppression. Models being examined include prion diseases of various species and murine and human retroviruses.

The major research goals of the laboratory are to understand basic pathogenic mechanisms induced by these infections, to study immune or other defense mechanisms used by infected individuals against infections, and to develop drug therapies capable of reducing or eliminating such infections.



Bruce W. Chesebro, M.D.

Chief, Laboratory of Persistent Viral Diseases

Chief, TSE/Prion and Retroviral Pathogenesis Section, LPVD

www.niaid.nih.gov/labs/aboutlabs/lpvd/TSEPrionRetroviralPathogenesisSection

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Major Areas of Research

- Transmissible spongiform encephalopathies, or prion diseases
- Retroviral brain diseases

Dr. Chesebro received his M.D. from Harvard Medical School in 1968. He completed postdoctoral studies at the Karolinska Institute, Sweden, in 1967; at Stanford University from 1968 to 1970; and at the National Institute of Arthritis and Metabolic Diseases from 1970 to 1972. He came to NIAID in 1972 and became chief of the Laboratory of Persistent Viral Diseases in 1979. He was elected a fellow in the American Academy of Microbiology in 2011.



Gerald S. Baron, Ph.D.

Chief, TSE/Prion Cell Biology Section, LPVD

www.niaid.nih.gov/labs/aboutlabs/lpvd/TSEPrionCellBiologySection

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Major Areas of Research

- TSEs (prion diseases)
- Determining mechanisms of infection, intra- and intercellular transport of TSE agents, and neurodegeneration
- Defining the nature of the TSE agent

Dr. Baron received his Ph.D. in biochemistry from the University of Victoria, Canada, in 1998, studying genes required for intramacrophage growth of the facultative intracellular bacterium *Francisella tularensis*. He conducted his postdoctoral research on prions and transmissible spongiform encephalopathies (TSEs) in the laboratory of Dr. Byron Caughey at NIAID's Rocky Mountain Laboratories. In 2005, he established an independent laboratory as a tenure-track investigator.



Byron Caughey, Ph.D.

Chief, TSE/Prion Biochemistry Section, LPVD

[www.niaid.nih.gov/labs/aboutlabs/lpvd/
TSEPrionBiochemistrySection](http://www.niaid.nih.gov/labs/aboutlabs/lpvd/TSEPrionBiochemistrySection)

bcaughey@nih.gov

Dr. Caughey received his Ph.D. in biochemistry from the University of Wisconsin-Madison in 1985 and completed postdoctoral studies in pharmacology at Duke University Medical Center from 1985 to 1986. He has conducted transmissible spongiform encephalopathy (TSE)/prion research in the Laboratory of Persistent Viral Diseases since 1986. He became a tenured senior investigator in 1994. Dr. Caughey is an editor for the *Journal of Virology*.

Major Areas of Research

- TSEs (prion diseases)
- Prion structure, amplification and detection, and disease prevention and therapeutics
- Prion protein functions and cell biology
- Protein-folding diseases



Leonard H. Evans, Ph.D.

Chief, Retroviral Molecular Biology Section, LPVD

[www.niaid.nih.gov/labs/aboutlabs/lpvd/
retroviralMolecularBiologySection](http://www.niaid.nih.gov/labs/aboutlabs/lpvd/retroviralMolecularBiologySection)

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Dr. Evans received his Ph.D. in biochemistry in 1977 at the Oregon Health Sciences University in Portland. He did postdoctoral studies on the genetic structure of retroviruses in the department of molecular and cellular biology at the University of California-Berkeley from 1977 to 1980. He then joined NIAID's Rocky Mountain Laboratories, where he is currently a senior investigator in the Laboratory of Persistent Viral Diseases.

Major Areas of Research

- Mixed retrovirus infections
- Interactions of exogenous retroviruses with their endogenous counterparts
- Genetic alterations of retroviruses and their role in disease
- Retroviral vectors for gene delivery



Kim J. Hasenkrug, Ph.D.

Chief, Retroviral Immunology Section, LPVD

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Major Areas of Research

- Mechanisms of vaccine protection against retroviral infection
- Chronic retroviral infections: immunological control, regulatory T cells, immunomodulation, and therapeutics
- Mechanisms of genetic resistance to retroviral disease

Dr. Hasenkrug received his Ph.D. in cell biology from the Albert Einstein College of Medicine in 1991 and conducted his postdoctoral research in the laboratory of Dr. Bruce Chesebro at NIAID's Rocky Mountain Laboratories. In 1998, he established an independent laboratory to study retroviral immunology and mechanisms of vaccine protection. A special focus of his work has been the study of the establishment and maintenance of chronic infections and virus escape. Dr. Hasenkrug serves as an affiliated associate professor at Montana State University and the University of Montana and as a scientific advisor for the International AIDS Vaccine Initiative.



Karin E. Peterson, Ph.D.

Chief, Neuroimmunology Unit, LPVD

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Major Areas of Research

- Influence of innate immune responses on 1) the function of intrinsic brain cells during viral infections, 2) retrovirus infection and pathogenesis in the CNS, and 3) bunyavirus infection and pathogenesis in the CNS
- Autonomous and non-autonomous mechanisms of innate-immunity-induced neuronal damage/protection during viral infections of the CNS

Dr. Peterson received her Ph.D. in microbiology and immunology in 1998 from the University of Missouri Medical School, where she studied autoimmunity and the activation of self-reactive T cells. She then went to NIAID's Rocky Mountain Laboratories (RML) in 1998 as a postdoctoral fellow in the Laboratory of Persistent Viral Diseases and applied her skills in immunology toward understanding the mechanisms that control the immune response to retrovirus infection. During this time, she became interested in the immune responses to virus infections in the central nervous system (CNS). In 2004, Dr. Peterson accepted a position as an assistant professor at Louisiana State University School of Veterinary Medicine, where she furthered her studies on viral pathogenesis in the CNS and also taught classes in immunology and virology. In 2008, she returned to RML as a tenure-track investigator to study the innate immune responses in the CNS and their role in viral pathogenesis.



Suzette A. Priola, Ph.D.

Chief, TSE/Prion Molecular Biology Section, LPVD

[www.niaid.nih.gov/labs/aboutlabs/lpvd/
tseprionmolecularbiologysection](http://www.niaid.nih.gov/labs/aboutlabs/lpvd/tseprionmolecularbiologysection)

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Dr. Priola received her Ph.D. in microbiology and immunology in 1990 from the University of California, Los Angeles. In 1991, she joined NIAID's Rocky Mountain Laboratories, where she is now a senior investigator. She currently is chief of the TSE/Prion Molecular Biology Section and serves on the editorial boards of both the *Journal of Biological Chemistry* and *Virology*.

Major Areas of Research

- Prion diseases
- Molecular mechanisms of neurodegenerative diseases

Ronald N. Germain, M.D., Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lbsb
301-496-1904

Sections and Units

Lymphocyte Biology Section
Ronald N. Germain, M.D., Ph.D.

Signaling Systems Unit
Iain Fraser, Ph.D.

Computational Biology Unit
Martin Meier-Schellersheim, Ph.D.

Cellular Networks Proteomics Unit
Aleksandra Nita-Lazar, Ph.D.

Systems Genomics and Bioinformatics Unit
John Tsang, Ph.D.

T-Cell Biophysics Unit
Rajat Varma, Ph.D.

Research Activities

Modern technology now allows for the analysis of immune responses and host-pathogen interactions at a global level, across scales ranging from intracellular signaling networks to individual cell behavior to the functioning of a tissue, an organ, and the whole organism. The challenge is not only to collect the large amounts of data such methods permit, but also to organize the information in a manner that enhances our understanding of how the immune system operates or how pathogens affect their hosts.

To do this, it is necessary to develop detailed quantitative models that can be used to predict the behavior of a complex biological system, whose properties help explain the mechanistic basis for physiological and pathological responses to infection or vaccination and can be used to design new therapies or vaccines.

Achieving this goal requires an interdisciplinary effort, and the Laboratory of Systems Biology (LSB) is designed to address this challenge.

LSB is an integrated group of scientists and support staff, rather than a collection of independent laboratories. Although it has been established within NIAID, it is expected to play a major role in fostering the growth of systems biology efforts across NIH, through its development of new software tools for complex systems modeling and high-throughput screening.



Ronald N. Germain, M.D., Ph.D.

Chief, Laboratory of Systems Biology

Chief, Lymphocyte Biology Section, LSB

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Dr. Germain received his Sc.B. and Sc.M. from Brown University in 1970 and his M.D. and Ph.D. from Harvard Medical School and Harvard University in 1976. From 1976 to 1982, he served as an instructor, assistant professor, and associate professor of pathology at Harvard Medical School. From 1982 to 1987, he worked as a senior investigator in the Laboratory of Immunology (LI). In 1987, he was appointed chief of the Lymphocyte Biology Section of LI. In 1994, Dr. Germain was named deputy chief of LI. In 2006, he became director of the NIAID Program in Systems Immunology and Infectious Disease Modeling, which became the Laboratory of Systems Biology in 2011.

Major Areas of Research

- T-cell receptor signaling in response to peptide/MHC molecule binding
- Computational modeling of T-cell ligand discrimination
- Control of immune cell migration and cell-cell interaction *in vivo* by structural and chemical cues
- Intravital imaging, analysis, and modeling of immune cell dynamics



Iain D.C. Fraser, Ph.D.

Chief, Signaling Systems Unit, LSB

www.niaid.nih.gov/labs/aboutlabs/lbsb/Pages/signalingSystems.aspx

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Dr. Fraser received his B.S. in biochemistry from Heriot-Watt University, Edinburgh, in 1990 and his Ph.D. in biochemistry from Imperial College, University of London, in 1995. He was a Wellcome Trust International postdoctoral fellow at the Vollum Institute in Portland, Oregon, from 1996 to 1999. He joined the Alliance for Cellular Signaling (AfCS) research consortium in 2000 as lead scientist of the molecular biology group at the California Institute of Technology and became co-director of the AfCS Molecular Biology Laboratory in 2005. He joined NIAID in 2008 as leader of the Molecular and Cell Biology Team, which became the Signaling Systems Unit in 2011.

Major Areas of Research

- Analysis of the signaling pathway interactions in immune cells that define context-specific responses to pathogens
- Profiling and modeling of the cellular response to complex stimuli
- Application of RNAi screening technology to the identification of signaling network components in immune cells
- Design and implementation of high-throughput and high-content assays to facilitate computational modeling of immune cell behavior and function



Martin Meier-Schellersheim, Ph.D.

Chief, Computational Biology Unit, LSB

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Major Areas of Research

- Computational modeling and simulation of intra- and intercellular signaling processes
- Exploration of how intracellular reaction-diffusion processes determine cellular communication and behavior
- Investigation of T-cell proliferation, differentiation, and death to identify mechanisms of T-cell homeostasis and the reasons for its failure after HIV/SIV infection
- Development of interfaces between proteomic databases and computational modeling tools

Dr. Meier-Schellersheim obtained a master's degree in physics in 1997 and a Ph.D. in 2001 from the University of Hamburg. His research focuses on building a bridge between experimental and computational cell biology through the development and application of modeling tools that combine graphical interfaces with the capability to perform spatially and temporally highly resolved simulations, even for models of complex cellular signaling processes.



Aleksandra Nita-Lazar, Ph.D.

Chief, Cellular Networks Proteomics Unit, LSB

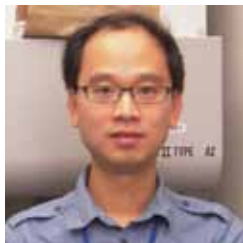
www.niaid.nih.gov/labs/aboutlabs/lbs/Pages/cellularnetworksproteomics.aspx

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Major Areas of Research

- Protein modifications involved in cell signaling
- Absolute quantification of molecular representation and interaction

Dr. Nita-Lazar received her Ph.D. in biochemistry in 2003 from the University of Basel for studies performed at the Friedrich Miescher Institute for Biomedical Research, where she analyzed protein glycosylation using mass spectrometry methods. After postdoctoral training at Stony Brook University and Massachusetts Institute of Technology, where she continued to investigate post-translational protein modifications and their influence on cell signaling, she joined the NIAID Program in Systems Immunology and Infectious Disease Modeling, now the Laboratory of Systems Biology, in April 2009.



John Tsang, Ph.D.

Chief, Systems Genomics and Bioinformatics Unit, LSB

Head, Computational Systems Biology,
Trans-NIH Center for Human Immunology

www.niaid.nih.gov/labs/aboutlabs/lbsb/Pages/genomicsBioinformatics.aspx

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Dr. Tsang received his Ph.D. in biophysics from Harvard University and B.A.Sc. and M.Math. in computer engineering and computer science, respectively, from the University of Waterloo in Canada. After graduating in 2000, he helped pioneer high-throughput computational and experimental methods to annotate the then-freshly sequenced human genome using custom DNA microarrays at Rosetta Inpharmatics. He then led a bioinformatics group at Caprion Proteomics. After earning his Ph.D. in 2008, he returned to Rosetta/Merck Research Laboratories to work with Dr. Eric Schadt on integrative genomics and genetics of gene expression in humans and mice. He came to NIH in August 2010, where he has been leading a research program to develop and apply computational and experimental approaches to tackle problems in immunology. He also was appointed as the head of computational systems biology at the Trans-NIH Center for Human Immunology.

Major Areas of Research

- Systems immunology
- Computational approaches to integrate diverse data types to obtain novel biological insights; biological circuit reconstruction
- Functions of phenotypic heterogeneity and stochastic gene expression of innate immune cells
- Systems biology of host-microbiome interactions
- MicroRNA functions and networks and their roles in imparting phenotypic robustness
- Statistical genetics



Rajat Varma, Ph.D.

Chief, T-Cell Biophysics Unit, LSB

www.niaid.nih.gov/labs/aboutlabs/lbsb/Pages/varma.aspx

varmarajat@niaid.nih.gov

Dr. Varma received his Ph.D. in cell biology from the National Center for Biological Sciences, India, where he studied the organization of GPI-anchored proteins in living cells using FRET microscopy. His postdoctoral training took place at the Skirball Institute for Biomolecular Medicine, New York University, where he described TCR microclusters as sites of signaling. He joined the NIAID Laboratory of Cellular and Molecular Immunology in the winter of 2007 and transitioned to the Laboratory of Systems Biology in the spring of 2012.

Major Areas of Research

- Translating ligand engagement to immune responses
- Diversity in T-cell receptor (TCR) proximal signals dictated by receptor-ligand interaction affinity
- Connecting proximal TCR signaling to transcription-factor activation
- Positive and negative regulation of TCR signaling via atypical Rho GTPase, RhoH
- Biology of the common gamma chain family of cytokine receptors

A large, detailed electron micrograph of a virus particle, likely a herpesvirus, showing its characteristic spherical shape and a dense outer envelope with numerous surface spikes. The image is rendered in shades of blue and white against a black background, highlighting the intricate structure of the viral capsid and envelope.

Laboratory of Viral Diseases

Bernard Moss, M.D., Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lvd
301-496-9869

Sections and Units

Genetic Engineering Section
Bernard Moss, M.D., Ph.D.

Viral Immunology Section
Jack R. Bennink, Ph.D.

Molecular Structure Section
Edward A. Berger, Ph.D.

Molecular Genetics Section
Thomas M. Kristie, Ph.D.

DNA Tumor Virus Section
Alison McBride, Ph.D.

Viral Pathogenesis Section
Ted C. Pierson, Ph.D.

Cellular Biology Section
Jonathan W. Yewdell, M.D., Ph.D.

Research Activities

The Laboratory of Viral Diseases carries out investigations on the molecular biology of viruses, the interactions of viruses with host cells, the pathogenesis of viral diseases, and host defense mechanisms. The studies are designed to increase fundamental knowledge as well as to facilitate the development of new approaches to the prevention and treatment of disease.

Current topics of basic research include viral entry into cells, regulation of gene expression, mechanisms of DNA replication, assembly and transport of viral proteins and particles, actions of viral growth factors and immune defense molecules, determinants of viral virulence, and viral targets of humoral and cellular immunity. Applied areas of research include development of recombinant expression vectors, candidate vaccines, and antiviral agents.

These studies involve a wide range of DNA and RNA viruses, including HIV, poxviruses, herpesviruses, papillomaviruses, influenza viruses, and polioviruses. The laboratory is equipped with an electron microscope, a confocal microscope, FACS machines, DNA sequencers, a DNA synthesizer, PCR machines, BiaCore apparatus, and ultracentrifuges. Laboratory members are interactive and hold weekly seminars in which current research is presented and discussed.



Bernard Moss, M.D., Ph.D.

Chief, Laboratory of Viral Diseases
Chief, Genetic Engineering Section, LVD

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bmoss@nih.gov

Dr. Moss received his M.D. from the New York University School of Medicine, interned at the Children's Hospital Medical Center (Boston), and then earned a Ph.D. in biochemistry from the Massachusetts Institute of Technology. He became interested in viruses after joining NIH and is well known for studies on the cap structure of mRNAs, regulation of gene expression, replication cycle of poxviruses, virus defense molecules, and development and application of virus vectors. Dr. Moss has received numerous awards and prizes, including most recently the International Poxvirus, Asfarvirus and Iridovirus Lifetime Achievement Award. He has been elected to the National Academy of Sciences and to the American Academy of Microbiology. He is a fellow of the American Association for the Advancement of Science and a past president of the American Society for Virology. Dr. Moss is currently an editor of *Virology* and a member of several editorial boards. He also is an adjunct professor at George Washington University and the University of Maryland.

Major Areas of Research

- Replication of poxviruses
- Viral immune defense proteins
- Recombinant vaccines



Jack R. Bennink, Ph.D.

Chief, Viral Immunology Section, LVD

www.niaid.nih.gov/labs/aboutlabs/lvd/cellBiologyAndViralImmunologySection

jbennink@niaid.nih.gov

Dr. Bennink obtained his Ph.D. from the University of Pennsylvania for the study of the specificity of virus immune effector T cells. He spent two years as a member of the Basel Institute for Immunology, followed by five years as assistant and associate professor at the Wistar Institute of Anatomy and Biology, before coming to the NIAID Laboratory of Viral Diseases in 1987. His research focuses on influenza virus and antigen processing and presentation to class I restricted antiviral T cells.

Major Areas of Research

- Discovery and definition of basic cellular processes involved in the generation of MHC class I peptide ligands
- Study of the underlying *in vivo* cellular events that lead to presentation of viral antigens to CD8+ T cells and the regulation of antiviral CD8+ T-cell responses
- Study of influenza virus immunity and virus adaptation



Edward A. Berger, Ph.D.

Chief, Molecular Structure Section, LVD

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eberger@niaid.nih.gov

Major Areas of Research

- Mechanisms of viral Env glycoprotein-receptor interactions and antibody neutralization mechanisms (HIV, herpesviruses, flaviviruses)
- Novel treatment and prevention strategies based on viral Env glycoprotein-receptor interactions

Dr. Berger earned his B.S. in chemistry from City College of the City University of New York in 1968. He received his Ph.D. in biochemistry and molecular biology in 1973 from Cornell University. He went on to do a postdoctoral fellowship in the department of genetics, biochemistry, and neurobiology at Stanford University School of Medicine from 1973 to 1976 and another fellowship in the department of cellular and developmental immunology at Scripps Clinical and Research Foundation from 1976 to 1977. He was a staff scientist with the Cell Biology Group at the Worcester Foundation for Experimental Biology, Shrewsbury, Massachusetts, from 1977 to 1987. He joined the NIAID Laboratory of Viral Diseases in 1987 and became chief of the Molecular Structure Section in 1995.



Thomas M. Kristie, Ph.D.

Chief, Molecular Genetics Section, LVD

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tkristie@niaid.nih.gov

Major Areas of Research

- Herpes simplex virus gene expression
- Transcriptional coactivators in herpesvirus lytic and latency reaction
- Chromatin control of herpesvirus lytic and latency-reaction cycles
- Mechanisms involved in RNAP II-mediated gene transcription

Dr. Kristie received his Ph.D. from the Committee on Virology at the University of Chicago for his work with Dr. Bernard Roizman on the regulation of herpes simplex virus gene expression. As a postdoctoral fellow with Dr. Philip Sharp at the Center for Cancer Research, Massachusetts Institute of Technology, Dr. Kristie focused on the interaction of components involved in the formation of transcriptional enhancer complexes. Dr. Kristie joined the NIAID Laboratory of Viral Diseases in 1993, became a senior investigator in 2000, and became chief of the Molecular Genetics Section in 2001.



Alison McBride, Ph.D.

Chief, DNA Tumor Virus Section, LVD

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Dr. McBride received a B.Sc. (with honors) in molecular biology from the University of Glasgow and a Ph.D. in biochemistry from the Imperial Cancer Research Fund and Imperial College, London, studying Epstein-Barr virus. She began working on human and other papillomaviruses as a postdoctoral fellow at the National Cancer Institute and joined NIAID in 1994. She became a senior investigator in the Laboratory of Viral Diseases in 2000.

Major Areas of Research

- Characterization of the mechanisms of viral genome establishment in keratinocytes
- Characterization of the mechanisms by which papillomavirus genomes are maintained and partitioned in dividing cells
- Determination of the role of the host DNA damage response and repair pathways in viral DNA replication
- Development of therapeutics to intervene in viral genome tethering
- Development of efficient methods to conditionally immortalize primary keratinocytes



Ted C. Pierson, Ph.D.

Chief, Viral Pathogenesis Section, LVD

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piersontc@niaid.nih.gov

Dr. Pierson received his Ph.D. from the Johns Hopkins University School of Medicine in 2001. While training in the laboratory of Dr. Robert F. Siliciano, he investigated the molecular biology of the pre-integration state of HIV-1 latency and the contribution of this relatively labile reservoir toward the persistence of HIV-1 in the face of aggressive antiretroviral therapy. After completing these studies, Dr. Pierson took a postdoctoral fellowship in the laboratory of Dr. Robert W. Doms in the department of microbiology at the University of Pennsylvania. While training there, Dr. Pierson initiated a new research program to study the cell biology of the envelope proteins of flaviviruses, with a focus on West Nile and dengue viruses. In 2005, Dr. Pierson was recruited to initiate the Viral Pathogenesis Section of the NIAID Laboratory of Viral Diseases.

Major Areas of Research

- Roles of the envelope glycoproteins during the flavivirus lifecycle
- Mechanisms of antibody-mediated neutralization of viruses
- Humoral immunity to flavivirus infection

**Jonathan W. Yewdell, M.D., Ph.D.**

Chief, Cellular Biology Section, LVD

www.niaid.nih.gov/labs/aboutlabs/lvd/cellBiologyAndVirallImmunologySection

[jyewdell@nih.gov](mailto: jyewdell@nih.gov)

Major Areas of Research

- Generation of MHC class I peptide ligands from endogenous and exogenous antigens
- Translational regulation in antiviral immune responses
- Immunodominance in antiviral B- and T-cell responses
- Intravital imaging of adaptive and innate antiviral immune responses
- Interaction of nervous and immune systems in viral infection
- Evolution of influenza A viruses in small animal models
- Biogenesis, function, and antigenicity of influenza A virus hemagglutinin and neuraminidase

Dr. Yewdell received an A.B. in biochemistry magna cum laude from Princeton University in 1975, working with Dr. Arnold Levine for his undergraduate thesis on immune recognition of virus-transformed cells. He received an M.D. and a Ph.D. in immunology from the University of Pennsylvania in 1981, working with Dr. Walter Gerhard on the mapping of influenza hemagglutinin epitopes using monoclonal antibodies. As a postdoctoral fellow, he worked with Dr. David Lane at the Imperial College in London, studying the newly discovered p53 protein. From 1983 to 1987, he was an assistant professor at the Wistar Institute in Philadelphia. In 1987, Dr. Yewdell joined the NIAID Laboratory of Viral Diseases and in 1993 was appointed to lead its Cellular Biology Section.



Laboratory of Virology

Heinz Feldmann, M.D., Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lv
406-375-7410

Sections and Units

Disease Modeling and Transmission Section
Heinz Feldmann, M.D., Ph.D.

Innate Immunity and Pathogenesis Unit
Sonja M. Best, Ph.D.

Tickborne Flavivirus Pathogenesis Section
Marshall E. Bloom, M.D.

Molecular Virology and Host-Pathogen
Interaction Unit
Hideki Ebihara, Ph.D.

Virus Ecology Unit
Vincent Munster, Ph.D.

Research Activities

The Laboratory of Virology (LV) conducts innovative scientific research on viral agents requiring high or maximum containment (biosafety level-2 to biosafety level-4). These agents include arenaviruses, bunyaviruses, filoviruses, flaviviruses, orthomyxoviruses, and paramyxoviruses. Research studies focus on vector/reservoir transmission, viral ecology, pathogenesis, pathophysiology, and host immune response to these viral pathogens. A significant goal is to develop diagnostics, vaccines, and therapeutics against these agents.

LV scientists broadly study pathogens that cause viral hemorrhagic fevers, viral encephalitis, and certain respiratory diseases. This work employs investigations in cell culture; animal models, including nonhuman primates; reservoir species; and arthropod hosts to elucidate viral pathogenesis, immune responses, molecular evolution, cellular and molecular biology, and vector-host interactions. In particular, LV scientists do the following:

- Study pathogenesis and pathophysiology of high-containment viral pathogens using molecular technologies
- Study immune responses to infection and vaccination and develop new vaccine candidates
- Study vector/reservoir transmission of high-containment viral pathogens using appropriate animal models
- Use *in vitro* and *in vivo* systems to study the interactions between viral pathogens or viral components and host cells and to develop new antiviral and other therapeutic strategies
- Study the epidemiology and ecology of high-containment pathogens using newly developed rapid, sensitive, and specific diagnostic systems



Heinz Feldmann, M.D., Ph.D.

Chief, Laboratory of Virology

Chief, Disease Modeling and Transmission Section, LV

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feldmannh@niaid.nih.gov

Dr. Feldmann received his B.Sc. in 1981 from the University of Giessen, Germany. He received his M.D. (1987) and Ph.D. (1988) from the University of Marburg, Germany. His postdoctoral research was conducted in the field of virology (filoviruses and hantaviruses) at the Institute of Virology, University of Marburg, and the special pathogens branch at the CDC, where he held a fellowship from the National Research Council. From 1999 to 2008, Dr. Feldmann held the position of chief of the special pathogens program of the National Microbiology Laboratory, Public Health Agency of Canada. Since 2008, he has been the chief of the NIAID Laboratory of Virology. Dr. Feldmann is a laboratory expert on high containment viruses (BSL-4) and serves as a consultant on viral hemorrhagic fevers and related pathogens for the World Health Organization. He is a member of several professional societies, an editor for *Archives of Virology* and *Virology Journal*, and serves on the editorial board of the *Journal of Virology* and *Virus Research*. Dr. Feldmann is an external scientific reviewer for national and international organizations and serves as a scientific consultant for high-containment laboratories. His professional interest is in the pathogenesis of hemorrhagic fever viruses and other emerging viral pathogens.

Major Areas of Research

- Disease modeling using rodent and nonhuman primate models
- Emergency vaccines using different replication-competent and replication-deficient viral vector platforms
- Antivirals and therapeutics
- Virus transmission in reservoir and host species



Sonja M. Best, Ph.D.

Chief, Innate Immunity and Pathogenesis Unit, LV

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Dr. Best received her Ph.D. in biochemistry and molecular biology from the Australian National University, where she studied the pathogenesis of myxoma virus. She conducted her postdoctoral research at NIAID's Rocky Mountain Laboratories on the complex role of apoptosis in the replication of parvoviruses. She stayed at NIAID as a research fellow and then a staff scientist to investigate virus-host interactions involved in flavivirus pathogenesis. It was during this time that she developed her interests in innate immunity and the molecular mechanisms used by flaviviruses to evade these critical host responses. In 2009, Dr. Best established an independent laboratory as a tenure-track investigator to expand her studies on interactions between pathogenic viruses and the host immune response. In 2011, Dr. Best received a Presidential Early Career Award for Scientists and Engineers.

Major Areas of Research

- Mechanisms used by pathogenic viruses to modulate host innate immunity
- Role of novel IFN-stimulated genes in host resistance to virus infection
- Importance of dendritic cell function to antiviral innate and adaptive immune responses



Marshall E. Bloom, M.D.

Chief, Tickborne Flavivirus Pathogenesis Section, LV

Associate Director for Science Management, Rocky Mountain Laboratories

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Dr. Bloom received his M.D. in 1971 from Washington University School of Medicine in St. Louis and joined NIAID's Rocky Mountain Laboratories (RML) in 1972 as a research associate. From 1975 to 1977, he was a postdoctoral fellow in the NIAID Laboratory of the Biology of Viruses in Bethesda, Maryland. He returned to RML as a tenured investigator in 1977 and was a charter member of the Laboratory of Persistent Viral Diseases. He is an expert on the molecular biology and pathogenesis of parvoviruses. In 2004, Dr. Bloom's research group changed its focus to the pathogenesis of tickborne flaviviruses. In 2002, Dr. Bloom was appointed associate director for science management for RML. In 2008, he was named associate director for science management for RML.

Major Areas of Research

- Comparative analysis of viral replication in mammalian and arthropod systems
- Viral determinants of neurovirulence and neuroinvasiveness
- Viral and host determinants of effective vertical and horizontal transmission



Hideki Ebihara, Ph.D

Chief, Molecular Virology and Host-Pathogen Interaction Unit, LV

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Dr. Ebihara received his Ph.D. in virology and molecular biology in 2001 from Hokkaido University, Japan, where he studied the pathogenesis and genetic determinants of virulence of hantaviruses. From 2001 to 2003, he completed postdoctoral research studying the molecular basis of Ebola virus pathogenesis at the School of Veterinary Medicine, University of Wisconsin-Madison. He continued his training first as a postdoctoral fellow (2003–2007) and then as a research associate (2007–2009) with the Institute of Medical Science, University of Tokyo, performing research on the molecular biology and pathogenesis of Ebola, Marburg, and hantaviruses. Dr. Ebihara was recruited to NIH in 2009 as a staff scientist in the Laboratory of Virology. In 2010, he established his own laboratory as a tenure-track investigator, studying the molecular mechanisms that underlie the pathogenesis of highly pathogenic human and animal RNA viruses.

Major Areas of Research

- Molecular determinants of filovirus virulence in animals
- Role of Ebola virus proteins in viral pathogenesis and lifecycle
- Identification of host cellular factors essential for Ebola virus replication
- Molecular characterization of pathogenic bunyaviruses
- Identification of bunyavirus host range and virulence determinants
- Mechanisms of bunyavirus evolution

**Vincent Munster, Ph.D.**

Chief, Virus Ecology Unit, LV

munstervj@niaid.nih.gov**Major Areas of Research**

- Natural reservoirs of emerging viruses and the underlying biotic and abiotic drivers of zoonotic and cross-species transmission events
- Evolutionary dynamics of emerging viruses in the context of virus-host ecology
- Modeling zoonotic and cross-species transmission of emerging viruses and the efficacy of outbreak intervention strategies

Dr. Munster received his Ph.D. in virology from Erasmus University, The Netherlands, in 2006. During his doctoral studies, he studied the ecology, evolution, and pathogenesis of avian influenza viruses. Dr. Munster continued his training in the department of virology at Erasmus Medical Center from 2006 to 2009, where he worked in the Center for Research on Influenza Pathogenesis and Surveillance, focusing on pathogenicity and human-to-human transmission of influenza A viruses. In 2009, Dr. Munster joined the Laboratory of Virology as a visiting fellow to expand his research interests in the ecology of emerging viruses to include filoviruses and henipaviruses. In 2012, he established the Virus Ecology Unit as an independent tenure-track investigator. The mission of the Virus Ecology Unit is to elucidate the ecology of emerging viruses and drivers of zoonotic and cross-species transmission. The Virus Ecology Unit combines field and experimental research and has established long-term study sites in the Republic of the Congo.



Laboratory of Zoonotic Pathogens

Tom G. Schwan, Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/lzp
406-363-9250

Sections and Units

Medical Entomology Section
Tom G. Schwan, Ph.D.

Gene Regulation Section
Frank Gherardini, Ph.D.

Plague Section
B. Joseph Hinnebusch, Ph.D.

Molecular Genetics Section
Patricia Rosa, Ph.D.

Research Activities

Scientists in the Laboratory of Zoonotic Pathogens (LZP) study diseases that are communicable from animals to humans. They conduct research to delineate the molecular basis of interaction between pathogens and their arthropod vectors, primarily ticks and fleas; define and identify pathogen and vector molecules that contribute to successful completion of pathogen transmission; and conduct research to examine differential gene regulation of pathogens during their transmission cycle in vertebrate hosts.

LZP goals include the search for antigens to improve serological tests for the laboratory confirmation of zoonotic pathogens and the maintenance of research expertise in the biology of ticks and fleas to enhance the understanding of pathogen survival and transmission. Major areas of research are as follows:

- Fleas, ticks, and other arthropod vectors
- Interaction between pathogens and vectors
- Pathogen and vector molecules involved in pathogen transmission
- Transmission cycle in vertebrate hosts



Tom G. Schwan, Ph.D.

Chief, Laboratory of Zoonotic Pathogens

Chief, Medical Entomology Section, LZP

www.niaid.nih.gov/labs/aboutlabs/lzp/medicalEntomologySection

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Major Areas of Research

- Adaptations of *Borrelia* spirochetes in ticks
- Genetic diversity of Lyme disease and relapsing fever spirochetes
- Development of better serological tests to detect human spirochetal infection
- Genomic studies of relapsing fever spirochetes
- Elucidation of geographic areas at risk for relapsing fever

Dr. Schwan received his Ph.D. in 1983 in parasitology from the University of California at Berkeley, studying the ecology of fleas and plague in Lake Nakuru National Park, Kenya. From 1983 to 1986, he was a postdoctoral fellow at the Yale Arbovirus Research Unit, Yale University School of Medicine, studying tickborne viruses. He joined NIAID's Rocky Mountain Laboratories in 1986. He served on the editorial board of the *Journal of Clinical Microbiology* for nine years and is on the editorial boards of *Vector Borne and Zoonotic Diseases* and *Emerging Infectious Diseases*.



Frank Gherardini, Ph.D.

Chief, Gene Regulation Section, LZP

www.niaid.nih.gov/labs/aboutlabs/lzp/geneRegulationSection

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Major Areas of Research

- Physiology, biochemistry, gene regulation, and pathogenesis of *Borrelia burgdorferi*
- *Treponema pallidum*
- *Burkholderia mallei*
- Identification of genes required for intracellular survival of *Burkholderia pseudomallei*

Dr. Gherardini received his doctorate in 1987 from the University of Illinois, studying enzymes involved in the utilization of galactomannans by *Bacteroides ovatus*. From 1991 to 2001, he was a tenured professor in the department of microbiology at the University of Georgia. In 2001, Dr. Gherardini joined NIAID's Rocky Mountain Laboratories, where he is chief of the Gene Regulation Section and a senior investigator in the Laboratory of Zoonotic Pathogens.



B. Joseph Hinnebusch, Ph.D.

Chief, Plague Section, LZP

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Dr. Hinnebusch received his Ph.D. in microbiology in 1991 from the University of Texas Health Science Center at San Antonio, studying the molecular structure and replication of linear plasmids of *Borrelia burgdorferi*. He joined NIAID's Rocky Mountain Laboratories as a postdoctoral fellow in 1992, where he developed model systems to study the transmission of *Yersinia pestis*, the bacterial agent of bubonic and pneumonic plague. He advanced to a tenure-track position in 2001 and is now a senior investigator and chief of the Plague Section in the Laboratory of Zoonotic Pathogens. From 2002 to 2006, he was the recipient of a New Scholar Award in Global Infectious Diseases from the Ellison Medical Foundation.

Major Areas of Research

- Interactions between *Yersinia pestis* and its vector *Xenopsylla cheopis* that lead to transmission
- Mechanisms of *Y. pestis* pathogenicity and immune evasion
- Aspects of the flea-bacteria-host transmission interface that influence nascent infection and immunity
- Characterization of a protective immune response to plague; new plague vaccines and diagnostics



Patricia Rosa, Ph.D.

Chief, Molecular Genetics Section, LZP

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Dr. Rosa received her doctorate in 1980 from the Institute of Molecular Biology at the University of Oregon. In 1988, following research fellowships at Washington University School of Medicine in St. Louis and at the Research Institute of Scripps Clinic, Dr. Rosa joined NIAID's Rocky Mountain Laboratories. She became a tenured investigator in 2000 and joined the newly formed Laboratory of Zoonotic Pathogens in 2005. Dr. Rosa is a fellow of the American Academy of Microbiology and an internationally recognized leader in the field of bacterial molecular genetics.

Major Areas of Research

- Development of a genetic system for *Borrelia burgdorferi*
- Analysis of the structure and function of the plasmid component of the highly segmented *B. burgdorferi* genome
- Determination of the roles of specific plasmids, genes, and proteins during the infectious cycle of *B. burgdorferi*

Research Technologies Branch

Robert Hohman, Ph.D., Chief

www.niaid.nih.gov/labs/aboutlabs/rtb
301-594-8198

Research Support Activities

The mission of the Research Technologies Branch (RTB) is to ensure that NIAID investigators have access to state-of-the-art research technologies. The branch develops technologies and project-specific applications for the NIAID intramural research program through a network of facilities located in Bethesda and Rockville, Maryland, as well as Hamilton, Montana. Scientists in RTB also provide training and consultation in experimental design, laboratory protocols, and data analysis.

- Light microscopy (confocal, multiphoton, colocalization, TIRF, FRET, high-resolution 3D imaging, laser microcapture, correlative techniques, and post-collection imaging processing)
- Electron microscopy (high-resolution scanning and transmission, cryoimmobilization/viewing, and immunolocalization of selected antigens)
- Flow cytometry (up to 13-color sorting, up to 14-color analysis, BSL-3 sorting and analysis, multispectral imaging cytometry, and multiplex bead array assays)
- Custom antibodies (hybridoma expansion, purification, and labeling)
- Protein chemistry (peptide synthesis, protein sequencing, mass spectrometry, protein ID, protein separation, and assay development)
- Genomics (Agilent SurePrint, Illumina BeadChip, and Affymetrix microarrays; microarray design; Illumina and Roche next-generation DNA sequencing; and Q-PCR)
- Bioinformatics and biostatistics (experiment design, data management, statistical analysis, exploratory analysis, data mining, and database integration)



Robert Hohman, Ph.D.

Associate Director, Research Technologies, DIR

Chief, Research Technologies Branch

Chief, Protein Chemistry Section, RTB

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Dr. Hohman received his Ph.D. in microbiology from NIH and the University of Maryland in 1982. After a three-year postdoctoral position in the laboratory of biochemistry at the Pasteur Institute in Paris, he returned to NIH for a second postdoctoral appointment. In 1992, he joined Oncor Inc., a biotechnology company that specialized in DNA diagnostics, and became the vice president of research and development. In 1998, Dr. Hohman became the vice president for research and development and general manager of the newly formed Intergen Discovery Products. In 2000, he was recruited back to NIH to become the DIR Associate Director for Research Technologies and chief of the Research Technologies Branch.

Major Areas of Research

- Technology development
- Biochemistry
- Biotechnology

**Rocky Mountain
Veterinary Branch**

**Douglas Brining, D.V.M.; Diplomat,
ACLAM; Acting Chief**

406-375-7415

Research Support Activities

The major research and support activities of the Rocky Mountain Veterinary Branch include basic immunology, molecular biology, and pathogenesis of bacterial, viral, and prion diseases in laboratory animal models; developing new animal models of emerging infectious diseases; vaccine development; increasing the efficiency and safety of animal biosafety level (ABSL)-4 research; and evaluating new caging systems for high-containment research. Current activities include the following:

- Hantavirus animal models and molecular reagents
- Testing novel vaccine candidates for ABSL-4 select agents
- Clinical care and animal model development
- Standard operating procedure development for high-containment animal research environments
- Full pathological services for infectious disease animal models
- Novel histopathology techniques for laboratory animal infectious disease models
- Training programs for laboratory animal procedures and biosafety in animal facilities
- Imaging techniques in the high-containment animal research environment





**Douglas Brining, D.V.M.; Diplomat,
ACLAM**

Acting Chief, Rocky Mountain Veterinary Branch

Acting Chief, Veterinary Pathology Section, RMVB

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Dr. Brining received his D.V.M. from Texas A&M University in 1999. He is a diplomate of the American College of Laboratory Animal Medicine. He was recruited to NIH to assist in the development and use of specialized animal models of emerging and re-emerging biodefense-related infectious disease agents requiring animal biosafety level-3 and level-4 containment.

Major Areas of Research

- Imaging
- Surgical modeling

Acronyms

BSC:	Board of Scientific Counselors
CBS:	Cytokine Biology Section
CHI:	Trans-NIH Center for Human Immunology
CMB:	Comparative Medicine Branch
CR-LRP:	Clinical Research Loan Repayment Program
DIR:	NIAID Division of Intramural Research
ERAS:	Electronic Residency Application System
EVPS:	Emerging Viral Pathogens Section
INRO:	Intramural NIAID Research Opportunities Program
IRTA:	Intramural Research Training Award
LAD:	Laboratory of Allergic Diseases
LCID:	Laboratory of Clinical Infectious Diseases
LHBP:	Laboratory of Human Bacterial Pathogenesis
LHD:	Laboratory of Host Defenses
LI:	Laboratory of Immunology
LICP:	Laboratory of Intracellular Parasites
LID:	Laboratory of Infectious Diseases
LIG:	Laboratory of Immunogenetics
LIR:	Laboratory of Immunoregulation
LMI:	Laboratory of Molecular Immunology
LMIV:	Laboratory of Malaria Immunology and Vaccinology
LMM:	Laboratory of Molecular Microbiology
LMVR:	Laboratory of Malaria and Vector Research
LPD:	Laboratory of Parasitic Diseases
LPVD:	Laboratory of Persistent Viral Diseases
LRP:	General Loan Repayment Program
LSB:	Laboratory of Systems Biology
LV:	Laboratory of Virology
LVD:	Laboratory of Viral Diseases
LZP:	Laboratory of Zoonotic Pathogens
NIAID:	National Institute of Allergy and Infectious Diseases
NIH:	National Institutes of Health
OTD:	Office of Training and Diversity
RML:	Rocky Mountain Laboratories
RMVB:	Rocky Mountain Veterinary Branch
RTB:	Research Technologies Branch
VP:	Visiting Program



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- P. 5** Phagocytosis of yeast particle by a human neutrophil; NIAID
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