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Training Program in
Infectious Diseases in the
Immunocompromised Host

Program Brochure

Fred Hutchinson
Cancer Research
Center

OVERVIEW

Program Description

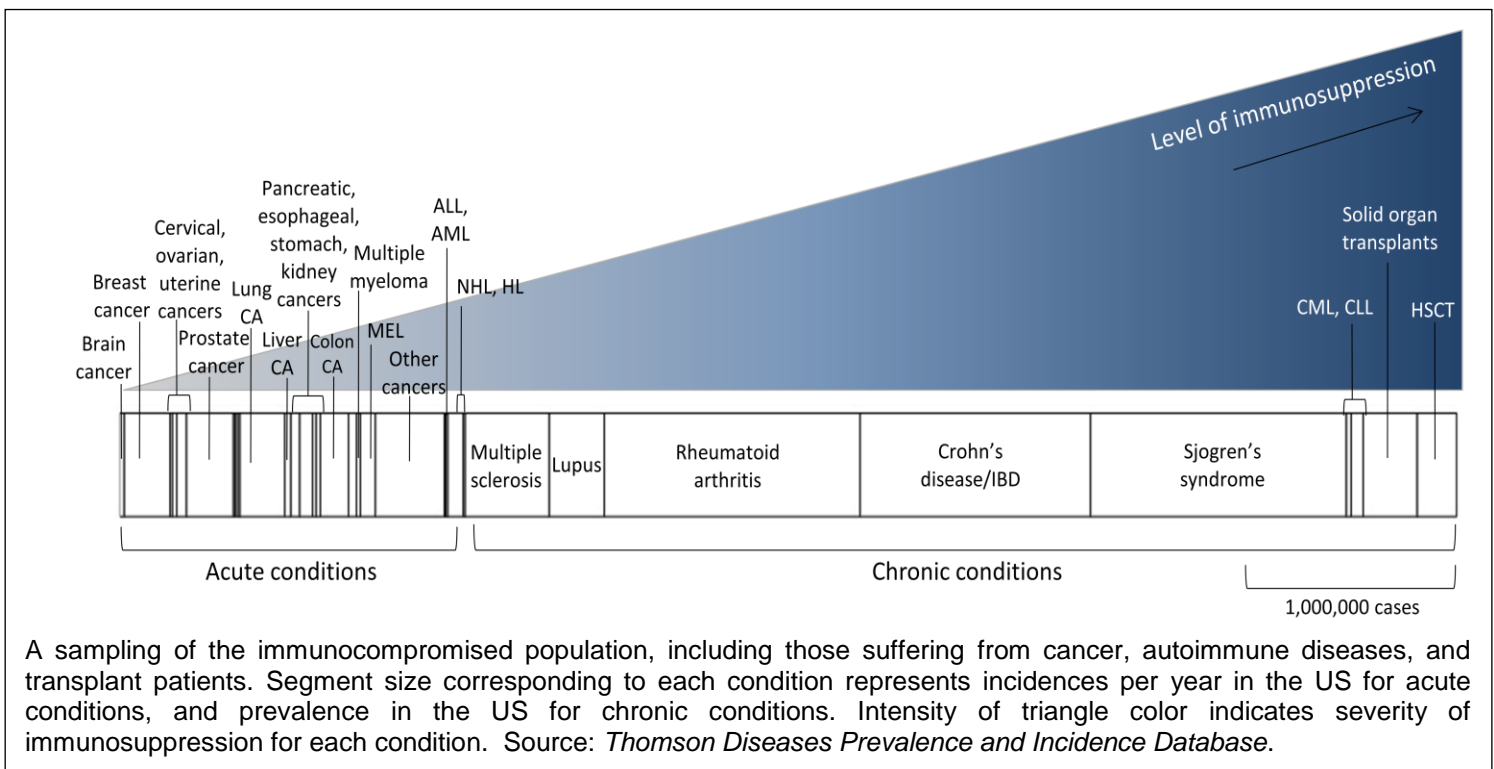
ABOUT THE TRAINING PROGRAM

The Training Program in Infectious Diseases in the Immunocompromised Host has been established to train MD and PhD students to perform clinically relevant research in infectious diseases within the immunocompromised population.

THE RATIONALE

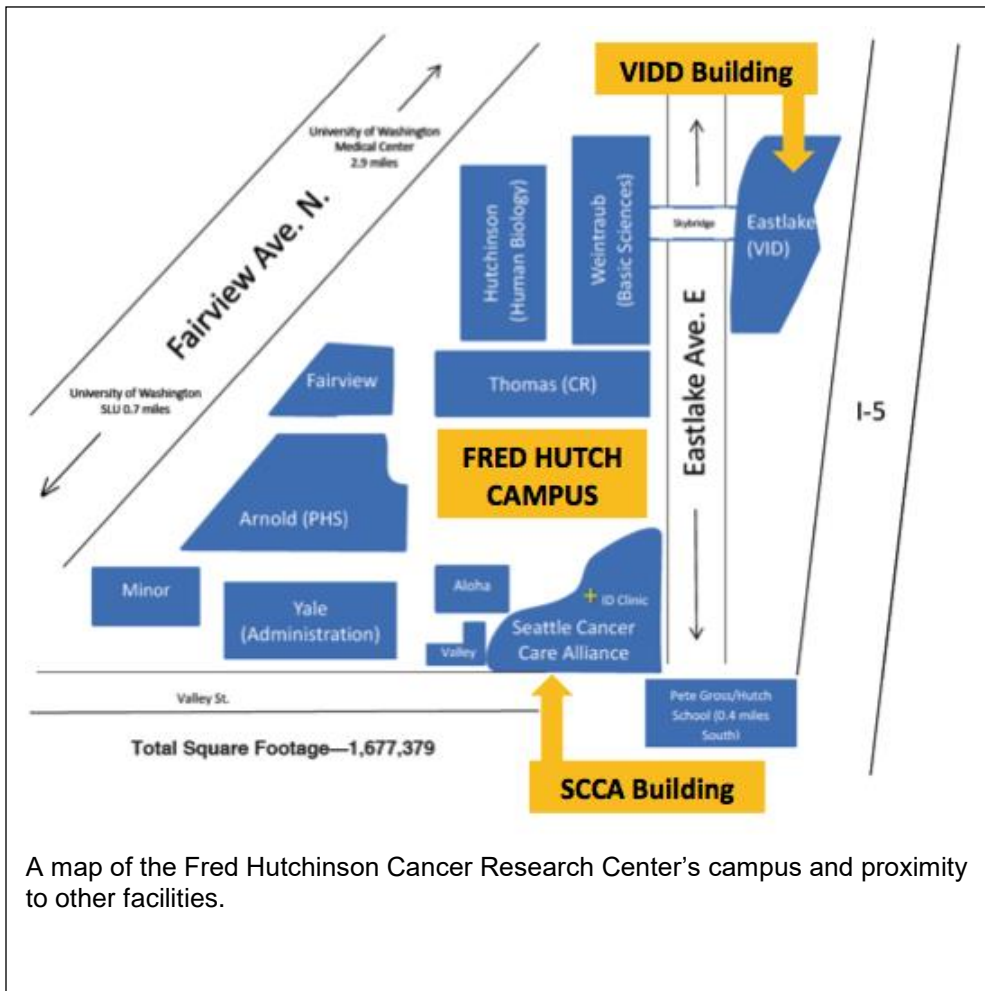
The overall burden of infectious diseases is on the rise. A 2007 WHO report warned that infectious diseases are spreading more rapidly than ever before, and new infectious diseases are being discovered at an unprecedented rate.

The proportion of the US population experiencing immunosuppression is also rising, partly attributed to the advancement of solid organ and hematopoietic stem cell transplantation techniques, therapies for autoimmune diseases, and immunosenescence (immunosuppression due to aging). Cancers and numerous immunologic disorders may also be linked to more specific or limited forms of immunocompromise, either by the immunosuppression caused directly by the disease or through the use of additional immunosuppressive treatments. This high-risk population experiences an increased risk of infectious diseases. Moreover, the outcomes of such infections and conditions, even those otherwise considered benign in healthy patients, can cause severe morbidity and mortality in the immunosuppressed.



This is a problem for which society demands effective and innovative solutions, and we aim to address it by providing the next generation of physician and postdoctoral scientists with specialized training in infectious diseases in immunocompromised hosts.

FRED HUTCHINSON CANCER RESEARCH CENTER AND THE SEATTLE CANCER CARE ALLIANCE



Fred Hutchinson Cancer Research Center (**Fred Hutch**) is a premier research institution in Seattle, Washington. Our interdisciplinary teams of scientists conduct research in the laboratory, at patient bedside, and in communities throughout the world to advance the prevention, early detection, and treatment of cancer and other diseases. Our researchers, including three Nobel laureates, bring a relentless pursuit of, and passion for, health knowledge and hope to their work and the world.

To accelerate the progress of clinical research, we are part of the Fred Hutchinson Cancer Research Center/University of Washington/Seattle Children's Cancer Consortium, or Seattle Cancer Care Alliance, a.k.a. **SCCA**. This research and clinical collaboration enables our scientists to leverage each institution's strengths and develop premier research programs across many types of diseases.

Furthermore, this consortium is among 40 National Cancer Institute-designated comprehensive cancer centers in the United States.

Our consortium partners' campuses are located within Seattle city limits and are linked by free shuttle services between campuses to promote interdisciplinary research and full access to consortium resources. The proximity of Fred Hutch, the University of Washington, Seattle Children's, and the SCCA, both physically and institutionally, provides an amazing support system and plethora of resources for researchers.

A 3-D Map of Fred Hutchinson Cancer Research Center is on the next page



BEHIND THE BRICKS: OUR SEATTLE CAMPUS

Overlooking South Lake Union, the Fred Hutch campus covers more than 15-acres with a dozen building that house five distinct research divisions, hundreds of labs and our patient outreach center, Seattle Cancer Care Alliance. Behind the bricks of six main buildings is where most of our breakthroughs originate:

1 EASTLAKE BUILDING

Home to the Vaccine and Infectious Disease Division, VIDD faculty lead the world's largest HIV Vaccine Trials Network (HVTN) while studying cancer-associated infections in more than 30 cities on five continents. A leader in Global Oncology, the Division has specific initiatives in Uganda, China and the Republic of South Africa to advance the understanding of infection-related cancers and infectious diseases that affect high-risk populations in these regions.

2 SEATTLE CANCER CARE ALLIANCE BUILDING

Fred Hutch, UW Medicine, and Seattle Children's formed Seattle Cancer Care Alliance (SCCA) to unite the oncology-related patient-care services of these organizations. In 2013, more than 6,000 patients were served by a team of 300 physicians who specialize in treating a wide range of blood and solid tumor cancers. SCCA patients also have access to the latest in cancer treatments, including:

3 WEINTRAUB BUILDING

Home to Basic Sciences, this division consists of 25 laboratories, each working in diverse areas related to all aspects of biology. The labs employ structural, genetic, molecular, cellular, developmental, and evolutionary biology methods to address unresolved questions in biology — including a thorough analysis of the internal workings of cells as well as the complex interactions between cells and organisms.

4 THOMAS BUILDING

Named for Nobel Laureate Dr. E. Donnall Thomas, this building is home to the Clinical Research Division, a group with more than 100 faculty members and dozens of individual labs. Their focus has expanded to encompass 12 diverse areas of research including hematopoietic cell transplantation, immunotherapy, gene therapy, solid tumor biology and genomics.

5 HUTCHINSON BUILDING

Home to the Human Biology Division, this group of scientists has expertise in molecular and cell biology, genomics, genetics, virology, infectious disease, computational biology, pathology and clinical research. It also includes the STR (Solid Tumor Translational Research) — a multidisciplinary, multi-institutional team that uses state-of-the-art technology and scientific innovation to turn laboratory findings, population studies and clinical insights into clinical practice.

6 YALE

Home to our administrative departments (Development, Human Resources, Information Technology, Finance and Communications & Marketing), these groups support five scientific divisions (representing more than 200 faculty) as well as 300+ lab websites, clinical trials databases platform infrastructure for new analytics and biotools.

2 SEATTLE CANCER CARE ALLIANCE

4 THOMAS

7 ARNOLD BUILDING

Three key research initiatives are based here: PHS (Public Health Sciences), WHI (Women's Health Initiative) and HICOR (Hutchinson Center for Outcomes Research).

PHS is the nation's oldest and largest program devoted to cancer-prevention research.

WHI is a long-term research program designed to address the most frequent causes of death, disability and poor quality of life in older women. It is one of the largest and most diverse U.S. prevention studies of its kind.

HICOR partners with patients, physicians and insurance groups to bridge science and clinical practice to provide guidance on the most effective patient treatments.



3-D map by Infographic World for Fred Hutch

INFECTIOUS DISEASE SCIENCES PROGRAM (IDS) OF THE VACCINE AND INFECTIOUS DISEASE DIVISION (VIDD)

INFECTIOUS DISEASE SCIENCES PROGRAM (IDS)

The Training Program in Infectious Diseases in the Immunocompromised Host is based in the Infectious Disease Sciences Program (**IDS**) of VIDD with close collaborations and interactions with other divisions as well as various departments and units within the University of Washington and Seattle Children's.

Established in the 1980s at Fred Hutch, IDS has been home to many major innovative programs, including projects to study herpesvirus infections, respiratory viruses, invasive fungal disease, the microbiome and its role in human disease, HIV vaccine research, infection-related cancers, and infection control and hospital epidemiology.

Our researchers conduct interdisciplinary collaborative research and training at the highest level of excellence. The IDS Program has strong and long-standing collaborations and partnerships with multiple stakeholders, including patients and researchers, physicians and medical centers, data scientists and policy makers, industry sponsors, and federal agencies.

IDS's mission is to advance knowledge of host-pathogen interactions and develop innovative management strategies for infectious diseases in immunocompromised and immunocompetent persons.

VACCINE AND INFECTIOUS DISEASE DIVISION (VIDD)

Fred Hutch comprises of five scientific divisions: Basic Sciences, Clinical Research, Human Biology, Public Health Sciences, and Vaccine and Infectious Disease (**VIDD**). VIDD's mission is to develop treatments and prevention strategies that counter infectious diseases throughout the world. Investigators working in VIDD research the human immune system, pathogens, and vaccines via statistical, clinical, and laboratory science. VIDD comprises several programs: Infectious Disease Sciences; Biostatistics, Bioinformatics and Epidemiology, which includes the Statistical Center for HIV and AIDS Research and Prevention (SCHARP); Immunology and Vaccine Development; and Global Oncology.

VIDD is home to one of the world's largest HIV research units and is the hub of the international HIV Vaccine Trials Network (HVTN), a global effort to develop and test a successful HIV vaccine. We have also been making a global impact with our prevention and treatment work by initiating collaborations with global partners such as the Uganda Cancer Institute, the Cape Town HVTN Immunology Laboratory in South Africa, and the China CDC.

THE GOAL

The mission of our training program is to develop the next generation of physician and postdoctoral scientists with expertise in infectious diseases in the immunocompromised host. Our goal is to provide rigorous and interdisciplinary training to foster innovative and collaborative research in infectious diseases in the transplant setting and other known and emerging areas of immunosuppression. We aim to train individuals who will use that expertise to advance knowledge and develop innovative strategies to prevent, treat and control these infections. Fred Hutch, with its variety of resources and established training success, is uniquely suited to this goal.

THE CURRICULUM

The core curriculum for the training program includes formal courses, didactic exercises and conferences that are important for all trainees regardless of their degree or research interests/projects. Some of the training is skills-based and covers key learning objectives, while others involve attendance and interactive research-focused group events.

CORE EXPECTATIONS

- Participation in core curriculum components.
- Development of critical skills in research methodologies relevant to an individual discipline or track.
- Development of skills in presenting research. All trainees are expected to present their research at local, national, and sometimes international meetings.
- Development of skills in scientific writing. A critical goal of this training program is to nurture skills in writing scientific papers, research proposals, and grant applications.

CORE CURRICULUM ELEMENTS

Orientation Course in Infections in Immunocompromised Hosts

In August of each year, all new trainees attend a one or two day orientation course in which program faculty and track leaders address research in immunocompromised hosts, in addition to human subjects training. The course also introduces trainees to faculty members and to one another.

Annual Retreat on Infections in Immunocompromised Hosts

The program hosts an all-day research retreat. All of the training program faculty and trainees are encouraged to attend. MD and PhD scientists supported on the training grant (as well as others receiving training in the field, e.g., international scientists) present their on-going research for discussion. All presenters receive immediate feedback on their presentations from at least two program faculty. The feedback and discussion are meant to further develop individual skills in presentation, data analysis, and interaction with other scientists.

Allergy and Infectious Disease Orientation Course for MD Fellows

MD fellows also attend a two-week orientation course covering a broad range of clinical ID topics at the beginning of their clinical years (which precedes the start of the research fellowship covered by this program).

Research in Progress Reporting and Participation

Each trainee will attend research in progress meetings with their mentors. In addition, trainees are required to present at least once every year their research progress at either an internal or external conference or lecture series that focuses on infections in the immunocompromised host.

Vaccine and Infectious Disease Division Seminar Series

This weekly seminar series is held on Tuesday afternoons at Fred Hutch, and features research presentations from faculty, scientists, senior fellows/postdocs, and guest speakers on a broad range of topics including infectious diseases, immunology and biostatistics.

Solid Organ Transplantation (SOT) Grand Rounds

The weekly seminars cover topics in SOT including infectious disease and immunology topics, featuring both local and external speakers.

Fred Hutch Student-Postdoc Advisory Committee (SPAC) Seminars and Workshops

The seminars and workshops are intended to enhance the professional development of trainees so that they master the skills necessary for a successful career and learn about the types of careers that are available to them in both academia (including grant writing) and non-academic fields.

Fred Hutch Research Ethics Education Program

Fred Hutch-based trainees (postdoctoral researchers, clinical fellows, and graduate students) are required, during their tenure at Fred Hutch, to attend six approved events. One of the six events must be a case study discussion group.

ITHS Clinical and Translational Boot Camp

This two-day course introduces ID fellows to the latest information about clinical and translational research, including observational studies and clinical trials.

Conferences and Seminars

In addition to required participation in the courses and meetings above, all trainees choose among a number of scheduled research seminars at the Seattle Cancer Consortium institutions, based on their area of focus. The Seattle Cancer Consortium is a vibrant research environment with a broad range of lectures that are relevant to the proposed training. The training grant program director and administrative staff will invite trainees to these additional lectures by email.

Journal Club

A journal club focused on infections in the immunocompromised host will be held every other month. Faculty and trainees working in the field are invited. Trainees will be asked to review and discuss interesting articles relevant to the training grant goals.

Joint Opportunities with Related Programs

Several linkages with the pediatric ID fellowship program have been developed to benefit both programs. Due to these linkages, both pediatric and adult ID fellows participate in most elements of the Core Curriculum, including orientation sessions, weekly conferences, an annual research retreat and journal clubs. Two pediatric faculty serve as mentors in this program (Dr. Englund, Dr. Zerr).

Didactic or Graduate Courses

MDs participating in **Tracks 1 and 4** will have the opportunity to obtain a master's degree in epidemiology at the UW. The UW-based Institute of Translational Health Sciences (ITHS) offers reduced tuition for Fred Hutch-based program participants. Alternatively, the Harvard School of Public Health offers a summer program in clinical effectiveness. This prestigious and intensive eight-week course focuses on the quantitative and analytical skills needed for a career in clinical research and is a shorter yet valuable alternative to a full degree program. Both options will be available to trainees in the appropriate tracks. Additional UW-based courses are available and the selection will be individualized during training planning meetings.

Advanced Clinical Training in Immunocompromised Host ID (MD track only)

Although the main focus of the T32 is training in research, we feel that future medical leaders in immunocompromised infectious diseases must have superior clinical training that goes beyond the standard training obtained during the first clinical fellowship year. Therefore, we created the following opportunities to enhance clinical experience and skills. We believe that these limited clinical activities are critical and will be synergistic with the research goals and, ultimately, create both clinically and academically competent leaders. The clinical commitment will be carefully monitored during the regular program review process.

- Basic training part of ID fellowship: focus on inpatient immunocompromised ID
- Participation in the outpatient clinics in hematopoietic cell transplant (HCT)/cancer and SOT
- Bi-weekly clinical transition meetings: these meetings are case-based and open to all fellows and faculty with interest in the immunocompromised ID; they are also attended by pulmonologists.
- Clinical care conferences: a quarterly meeting that discusses ID management issues, reviews abstracts from national ID conferences, and reviews autopsy findings.
- Participation in infection control meetings. We offer representative attendance in infection control meetings; many ID specialists will have to assume partial functions in infection control.

Facilities and Resources

The collaboration between the members of the Seattle Cancer Care Alliance provides access to a variety of resources for endeavoring researchers. These resources include, but are not limited to, the following:

CLINICAL

Clinical space is located at various locations across Seattle. As part of the Cancer Consortium, the SCCA clinic resides in a seven-story, 159,000 square foot facility on the Fred Hutch campus. It houses outpatient clinics, multi-bed clinical trial units, radiation oncology, diagnostic imaging, clinical laboratory, infusion therapy, apheresis, minor procedures, physical therapy, pharmacy, patient support services, and faculty and administrative offices. Additionally, the SCCA inpatient unit at the University of Washington Medical Center (UWMC) has 50 beds on the 7th and 8th floors.

Other affiliated sites and hospitals include UWMC and Seattle Children's Hospital. This unique network of hospitals gives fellows the opportunity to train under world-renowned physicians with diverse patient populations and access to world-class resources. Clinical training takes place at these locations.

The Infectious Disease clinics for HCT/cancer patients will be held at the SCCA building while the SOT ID clinic is located at the UWMC.

ANIMAL

Fred Hutch, along with its Consortium partnership organizations such as the UW, provides a broad variety of animal housing, veterinary, and research support services. The facility is fully accredited by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) and complies with all United States Department of Agriculture (USDA), Public Health Service (PHS), Washington State and local area animal welfare regulations. Comprehensive animal husbandry services are provided for all vertebrate animals used in the Consortium's programs of research. All housing and use of vertebrate animals is done in Comparative Medicine's centralized facilities which occupy approximately 50,000 net square feet.

COMPUTER

Fred Hutch's IT infrastructure and services are provided by a centralized department (Fred Hutch IT). It is currently staffed by 120 IT professionals that support, maintain and design Fred Hutch's complex heterogeneous research and administrative computing environments across multiple data centers. The services that Fred Hutch IT provides are extensive and they include:

- IT Help Desk support 8am to 5pm and 24/7 emergency IT on-call support
- Desktop, laptop and mobile computing management and support
- Clinical informatics systems/application management and support
- High Performance Computing (HPC), Scientific Computing support, and Software development support
- Messaging services: e-mail and calendar
- Anti-spam and anti-malware services
- Collaboration services: SharePoint
- Data storage services: SAN & NAS and Data protection services: file and database backups, off-site
- Connectivity services: wired networking, wireless, VPN and high-speed Internet access
- Telephone and voicemail services
- Security: encryption, firewalls, intrusion prevention, forensics and consulting

Fred Hutch IT manages the institution's Storage Area Network (SAN) which consists of a 3PAR/NetApp consolidated storage system and an Isilon Storage cluster to provide high throughput data access for High Performance Computing. The total networked storage capacity is currently 1 PetaByte. Data protection is implemented by DataDomain appliances in conjunction with Commvault Simpana backup software and IBM Tivoli Storage Manager.

In order to accommodate the growing demand for computer resources and mitigate the power demands of physical systems, many of the server services are provided by virtual systems using the advanced VMWare VSphere technology. The virtual systems have the added protection of being recoverable through snapshots which are taken and stored on a daily basis. The vSphere environment is configured as self-service Enterprise cloud and currently hosts more than 800 virtual machines.

Fred Hutch IT supports both UNIX/IMAP (Zimbra) and Microsoft Exchange for e-mail services. Fax and photocopier machines are also available throughout Fred Hutch.

Fred Hutch IT also provides support for over 60 applications that are made available to the entire organization including an enterprise level SharePoint Collaboration platform.

The Information Security Office (ISO) is part of Fred Hutch IT and is staffed with 5 FTEs. The ISO maintains a highly available Intrusion prevention system and high performance firewall.

OFFICE

Office space is provided by Fred Hutch to its divisions and programs. Faculty occupies offices, while fellows are provided work space within close proximity to their mentors. There are 93 conference rooms of varying sizes on campus with video conferencing capabilities in most of the larger conference facilities. Other amenities to campus buildings include secure file rooms and an on-site copy center.

OTHER RESOURCES AND SERVICES

The Shared Resources <https://www.fredhutch.org/en/research/shared-resources.html> at the Fred Hutch consist of facilities and/or laboratories which are available for use by Fred Hutch investigators, and affiliated external academic and biotechnology collaborators. The Shared Resources available include:

- Antibody Development
- Arnold Library
- Biologics Production
- Cell Processing
- Collaborative Data Services
- Collaborative Medicine
- Electron Microscopy
- Experimental Histopathology
- Flow Cytometry
- Genomics
- Glassware Services
- Immune Monitoring
- Nutrition Assessment
- NW Bio Trust
- Prevention Center
- Proteomics
- Scientific Imaging and Specimen Processing

These resources provide support for basic scientific research, clinical research and public health sciences projects and collaborations. Centralized facilities have proven to improve the feasibility and efficiency of performing clinical trials and permit more rapid translation of laboratory studies into clinical applications.

The resources serve the purpose of providing routine services for a variety of research activities, many of which are also focal points for technology dissemination and collaborative research. All resources are staffed by personnel with expertise specific to that facility. The facilities give the opportunity for investigators to augment their research with resources that would not otherwise be convenient or cost effective in each individual laboratory.

Fred Hutch also provides ongoing support for consultation on experimental design, approaches to troubleshooting, and assistance with data quality and analysis issues. In addition, training is provided to resource users in a variety of formats, including one-on-one, small group, online tutorials or class format. These include courses on use of specific instruments, analysis of data, and classes on best use of services.

Fred Hutch has over 7,800 NASF of dedicated space for liquid nitrogen units and freezer space for long-term specimen and sample storage. A well-established alarm system exists for freezers with 24/7 monitoring by Facilities Engineering.

Fred Hutch also provides a multitude of resources and data support for investigators, include vast data and clinical repositories. (Fred) Hutch **Integrated Data Repository and Archive** (HIDRA) is a collaborative effort of the Fred Hutch/University of Washington Cancer Consortium. The goal is to create a database that will enable scientists and physicians to learn from every new patient who comes through the door.

Also available to all researchers is the Fred Hutch's International Histocompatibility Cell and Data Bank. It houses a **Research Cell Bank** with a comprehensive inventory that includes B-Lymphoblastoid Cell Lines (B-LCL) from previous International workshops, HLA heterozygous and homozygous donors, selected families, and individuals of diverse population groups. The cell bank has blood, cells and DNA material from more than 20,000 HCT recipients and donors.

Within Infectious Disease Sciences, an established IRB-approved **Infectious Disease Biorepository** has collected over 200,000 specimens. This repository is open to all investigators for use, and continues to expand incorporating approved clinical and research protocols. The samples stored in the repository span more than 30 years of Fred Hutch history and are directly linked to 34 publications in peer-reviewed journals, including New England Journal of Medicine, Journal of Infectious Diseases, Bone Marrow Transplant, and Blood.

Fred Hutch has an on-site Clinical Research Support group whose mission is to support and facilitate research trials within the Cancer Consortium. The goal is to support the initiation and coordination of trials and to provide training and quality assurance functions that ensure high quality trials and results. Within this office, tools and resources are provided for investigators and the staff to both ensure compliance with regulatory requirements and make it easier for investigators to conduct research in an increasing complex environment.

Fred Hutch's Arnold Library provides high quality, responsive services and resources in support of our research, education and patient care programs. Our physical space houses study carrels with wireless Internet access, patron computers and the Shared Resources Computer Lab. The digital side of our operation encompasses subscription management for more than 25,000 ebooks, nearly 30,000 online journals and a variety of databases and web services. Librarians curate Fred Hutch researchers' profiles, provide institution-wide tracking of scholarly publishing, support Fred Hutch authors with NIH Public Access Policy compliance, manage the Shared Resources website and administer several institutional repositories.

Finally, the training program is serviced by a thrice-daily courier service to transport specimens and materials between clinics and laboratories through an affiliation with the Virology Division at the University of Washington. This service has been highly effective and beneficial over the past 2 decades in promoting interdisciplinary research.

Track Descriptions

Our program training has four different yet finely integrated tracks that represent not only the individual strengths of the training faculty but also areas of innovation and unmet scientific and medical need. A senior faculty mentor with outstanding credentials within the unique area has been selected to be the leader of each track.

1) EPIDEMIOLOGY, PATHOGEN DYNAMICS AND CLINICAL TRIALS

Michael Boeckh and Ajit Limaye, Co-Track Leaders

This track will provide trainees with excellent opportunities to develop skills in a broad range of areas related to the epidemiology of infections in HCT and SOT patients as well as moderately immunosuppressed patients, e.g., after a new diagnosis of cancer or those with autoimmune or chronic diseases requiring immunosuppressive treatment. The transplant ID programs at the Fred Hutch and UW have multiple and diverse ongoing projects that focus on the spectrum, risk factors, biomarkers/diagnostics, and outcomes of bacterial, viral, and fungal pathogens in HCT and SOT recipients. Through collaborations with faculty with expertise in mathematical modeling and biostatistics, this track will also provide trainees with in depth experience in the relationship between pathogen and clinical outcomes and host determinants of pathogen dynamics, an area with important implications for defining the pathogenesis of infections in immunosuppressed hosts and in the design of interventional studies. Studies will be facilitated by a state-of-the-art molecular diagnostic laboratory directed by Keith Jerome and an unparalleled sample biorepository. This track will also provide trainees with excellent opportunities to develop skills in all aspects of observational and interventional trials. Trainees will obtain experience in trial design, patient recruitment and retention, implementation, monitoring, regulatory aspects, funding, and data analysis. Training will be obtained through attendance at weekly clinical trial meetings for ongoing trials, coursework in biostatistics and epidemiology, and attendance at scientific meetings. The breadth of faculty expertise and the long and distinguished past track record of successful clinical investigator trainees will ensure that future trainees are well prepared for independent careers as translational investigators. Trainees in this track are encouraged to pursue a Master in Epidemiology/Public Health degree.

2) IMMUNOLOGY/IMMUNOGENETICS

Stanley Riddell, Track Leader

This track will conduct research on the specificity and function of human T cell responses to pathogens and malignancies essential for understanding host-pathogen interactions. After initial pioneering human trials of adoptively transferred T cell clones to prevent cytomegalovirus (CMV) infection after allogeneic HCT, human trials of T cell therapy including the use of gene-modified T cells are now a strong research focus and area for training. These studies require the development of techniques for viral antigen discovery, and for isolation, expansion, characterization and reinfusion of T cells into patients. Additional studies are directed at defining intrinsic qualities of T cells that enable superior persistence and efficacy after adoptive transfer with specific emphasis on the identification of a novel memory T cell subset in humans that is distinct in phenotype, gene expression profile, response to homeostatic cytokines, and functional properties. This track also offers research opportunities to define pathogen-specific and immune reconstitution dynamics in immunosuppressed populations and to characterize and optimize vaccine responses. Another area covered in this track is the genetic basis of infectious diseases. A unique cohort of 5000 HCT recipients and donors that has undergone genotyping facilitates genome wide association studies (GWAS) of infectious phenotypes as well as associated validation experiments. Gene expression studies characterizing signatures associated with progressive infectious disease in immunocompromised hosts are another area for prospective trainees. An exceptionally strong genomic shared resource facility supports these studies, including computational analyses.

3) MICROBIOME AND PATHOGENESIS

David Fredricks, Track Leader

This research track provides trainees with the opportunity to study the role of individual microbial pathogens (e.g., CMV, herpes simplex virus (HSV), respiratory viruses, *Clostridium difficile*, *Enterococcus faecalis*, *Aspergillus fumigatus*, and others) in transplant outcomes and infectious complications in the immunocompromised host. For example, postdoctoral fellows can investigate how CMV and HSV subvert the human immune response to establish lifelong infection, and the factors leading to reactivation of viral infection in the immunocompromised host. In addition, this track will provide a rich training environment for studying human-associated microbial communities (the indigenous microbiota) and their genes (the microbiome), with a focus on how bacterial communities at particular epithelial surfaces impact risk of infection and outcomes, such as graft-versus-host disease after HCT. Fred Hutch and the UW have a deep and diverse community of investigators studying aspects of the human microbiome and pathogenesis, providing many opportunities for rigorous laboratory-based investigation and career development. Fred Hutch hosts the Center for Human Microbial Ecology (CHuME) which will facilitate networking among trainees.

4) INFECTION PREVENTION AND HOSPITAL EPIDEMIOLOGY

Danielle Zerr, Track Leader

The Infection Prevention and Hospital Epidemiology Track provides trainees opportunities to study the epidemiology of healthcare-associated infections as well as potential interventions aimed at reducing the risk of such infections. Potential projects may focus on targeted organisms (e.g. multidrug-resistant organisms, respiratory viruses, etc.), targeted conditions (e.g. central line-associated bloodstream infections, etc.) or targeted interventions (e.g., chlorhexidine gluconate bathing, environmental decontamination, etc.). Studies may be grounded in basic epidemiology (e.g. describing population dynamics or natural history of these infections/diseases) or they may take the shape of an intervention study. Projects may also contain a laboratory element, such as molecular analysis of specific pathogens, that the trainee may be involved in. MD trainees in this track may earn MPH degrees, learning clinical and population-based epidemiologic methods. Fred Hutch, the UW, and Seattle Children's have a diverse community of investigators studying various aspects of healthcare epidemiology as well as clinicians active in the field, providing varied opportunities for clinical and epidemiology investigation and career development.

PROGRAM DIRECTOR

Michael Boeckh, MD, PhD, Head of the Infectious Disease Sciences Program, will serve as Program Director for the training program contributing 10% effort. This effort will be concurrent with his Program Head responsibilities and is compensated through funds provided by the Vaccine and Infectious Disease Division (VIDD) of Fred Hutchinson Cancer Research Center. As Program Director, Dr. Boeckh's responsibilities are to administer and oversee the training program, interact with NIAID and the different committees, oversee the integration of the training grant program into program activities to ensure the success of each trainee, and manage all other aspects of the training program.

EXTERNAL ADVISORY COMMITTEE

The External Advisory Committee (EAC) comprises four distinguished individuals (Kieren Marr, Nina Singh, David Snyderman, John Zaia) outside of our consortium organizations with strong credentials in both laboratory sciences and clinical research, expertise in obtaining NIH funding, and training the next generation of scientists.

INTERNAL ADVISORY COMMITTEE

The Internal Advisory Committee (IAC) comprises all track leaders as well as distinguished individuals from inside of Fred Hutch and our consortium organizations with strong credentials in training, laboratory sciences and clinical research expertise as well as familiarity with the mission of our training program. The IAC committee members are Drs. Nancy Davidson, Julie Overbaugh, Rhoda Morrow, Lisa Frenkel, Danielle Zerr, David Fredricks, Stan Riddell, Ajit Limaye, and Michael Boeckh.

SENIOR, JUNIOR AND SUPPORTIVE MENTORS

Training faculty with an especially strong expertise and track record in the fields of virology, molecular immunology, immunogenetics, microbial pathogenesis, epidemiology, clinical trials conduct and biostatistics, will serve as mentors. Senior mentors were selected based upon the excellence of their research, ability to secure competitive extramural funding, and mentoring records. Junior mentors have less mentoring experience, and mentorship skills will be developed by pairing them with a senior and a supportive mentor. All have a unique set of skills and achievements for which they were selected to serve on the training faculty. We anticipate that some of the junior mentors will move into the senior mentor rank during the next five-year grant period.

This co-mentoring approach has been a highly successful concept in our experience. It will not only increase access to mentors for the trainees but also provide leadership and guidance as the younger faculty member develops mentoring skills. Overall, this approach will enrich the training experience of co-mentored trainees.

Training Program Organization

Principal Investigator

Michael Boeckh

External Advisory Committee

Kieren Marr
Nina Singh
David Snyderman
John Zaia

Internal Advisory Committee

Nancy Davidson
Lisa Frenkel
Rhoda Morrow
Julie Overbaugh

All Track Leaders

Tracks	Epidemiology, Pathogen Dynamics and Clinical Trials	Immunology/ Immunogenetics	Microbiome and Pathogenesis	Infection Prevention and Hospital Epidemiology
Track Descriptions	Study the epidemiology, pathogen dynamics, biomarkers/diagnostics, risk factors of infections in HCT and SOT recipients through the design, conduct, and analysis of observational and interventional clinical trials.	Study the immunopathogenesis of infections, immunologic mechanisms, immunoreconstitution, vaccine responses, genetic bases of disease, genetic signatures of disease, systems biology approaches of immune and vaccine responses.	Study the human microbiome, with a focus on how bacterial communities at particular epithelial surfaces impact risk of infection and outcomes, such as GVHD after HCT. Study the mechanisms of individual microbial pathogens on outcomes in the immunocompromised host.	Study the epidemiology of healthcare associated with infections as well as potential interventions aimed at reducing the risk of such infections.
Senior Mentors	Michael Boeckh Ajit Limaye Janet Englund David Fredricks Peter Gilbert Keith Jerome Christine Johnston Anna Wald Danielle Zerr	Stan Riddell Larry Corey Michael Gale Tom Hawn David Koelle	David Fredricks Michael Boeckh Adam Geballe Keith Jerome David Koelle	Danielle Zerr Corey Casper Anna Wald
Junior Mentors	Josh Hill Josh Schiffer Alpana Waghmare	Warren Phipps Martin Prlc Justin Taylor Cameron Turtle	Alex Greninger Steven Pergam Josh Schiffer Cameron Turtle	Catherine Liu Steven Pergam
Supporting Mentors	Theodore Gooley Wendy Leisenring Amalia Magaret	Stephen DeRosa		Wendy Leisenring

NOTE: **Bold** indicates Track Leaders

Michael Boeckh, MD, PhD

Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch
Professor of Allergy and Infectious Diseases and Medicine, University of Washington
Head, Infectious Disease Sciences Program, Fred Hutch

Dr. Boeckh is a Full Member of the VIDC at the Fred Hutch, and a Professor of Medicine, Division of Allergy and Infectious Diseases, at the UW. He has been serving as the Program Head since 2012, and has been serving as a senior training program faculty for many years. Dr. Boeckh started mentoring numerous fellows and students in clinical research projects in 1994 and worked with a large number of people over the years. He has long-standing experience in patient-oriented research with clinical research projects in transplant recipients, including studies that examine the impact and epidemiology of and risk factors for CMV, respiratory viruses and fungal infections in transplantation and management strategies. He has been conducting large prospective observational and interventional studies supported by federal and non-federal funding sources. Dr. Boeckh's recent projects focus on complications of HCT relating to respiratory viral infections and the genetic predisposition to infectious complications. To perform this work, he has built an infrastructure to receive and process samples from patients undergoing HCT and used this system to build a biorepository. Dr. Boeckh is associated as faculty member with several T32 training programs in Seattle and is actively involved in fostering and evaluating the career development of his own trainees as well as many others in the field. He is also part of the External Advisory Committee of the Interdisciplinary Transplant Infectious Disease T32 grant at Duke University (T32 AI100851). Dr. Boeckh has authored over 196 peer-reviewed research publications, 5 editorials, 22 book chapters and reviews, and 59 other publications. He trained 10 postdoctoral ID fellows and 2 predoctoral students, as well as 12 international postdoctoral scientists.

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Corey Casper, MD, MPH

Interim President and CEO, Infectious Disease Research Institute
Affiliate Investigator, Vaccine and Infectious Disease Division, Fred Hutch

Over the past decade Dr. Casper's research has focused on infections as a cause and consequence of cancer, with an emphasis on HIV-associated malignancies. In 2004, he founded the Uganda Cancer Institute/Hutchinson Center Cancer Alliance and subsequently was the Founding Director of the Program in Global Oncology at the Fred Hutch; the goal of both initiatives is to study infections which cause cancer in a setting where more than 60% of cancers are caused by infectious diseases. To date, the research program has conducted over 50 studies of infection-related cancers with over 7,000 participants and over 150,000 archived specimens. The focus of Dr. Casper's work has been to describe the pathogenesis, treatment and prevention of infection-related cancers such as Human Herpesvirus-8-associated Kaposi Sarcoma, Epstein Barr Virus-associated lymphomas, human papillomavirus-associated anogenital cancers, and hepatitis B virus-associated liver cancer. Dr. Casper experience in

training physicians and scientists is exemplary with over 300 persons trained in Uganda to date and more than two dozen graduate and post-graduate mentees in Seattle.

In the United States Dr. Casper also conducts clinical and translational research on infections which complicate cancer care such as respiratory viruses and sepsis to due bacterial bloodstream infections.

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Lawrence Corey, MD

President and Director Emeritus, Fred Hutch Member, Vaccine and Infectious Disease, Public Health Sciences, and Clinical Research Divisions, Fred Hutch

Professor of Medicine and Laboratory Medicine; Lawrence Corey Endowed Chair in Medical Virology, University of Washington

Dr. Corey is a Full Member of VIDD at the Fred Hutch, Professor in Laboratory Medicine and Medicine at the UW and President and Director Emeritus at the Fred Hutch. In 1999, he reorganized the NIH HIV vaccine

program to integrate and expedite the development of HIV vaccines globally, developing the Fred Hutch - based HIV Vaccine Trials Network (HVTN), for which he has been Co-PI and PI since its establishment. He is an esteemed academic investigator with continuous NIH funding since 1978. Over the past 35 years, he has mentored and trained over 60 postdoctoral fellows, a majority of whom now hold faculty positions in academia and industry. His main areas of expertise have been in human virology; particularly HIV infections, herpesvirus complications in HCT, and infectious disease related cancers. His major area of laboratory expertise is in mucosal immunology of chronic viral infections.

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Stephen De Rosa, MD

Research Associate Professor of Laboratory Medicine, University of Washington

External Joint Associate Member, Vaccine and Infectious Disease Division, Fred Hutch

Dr. DeRosa is an Associate Professor at UW and an External Joint Associate Member at VIDD/Fred Hutch. He has been the Director of the Flow Cytometry Laboratory within the HIV Vaccine Trials Network (HVTN) Laboratory Program for the past twelve years. As such, he has been providing expertise in multiparameter flow cytometry assays to optimize the development, performance and analysis of flow cytometric assays that enumerate and characterize cellular responses in immune reconstitution and vaccine studies. He has been trained in the Herzenberg laboratory at Stanford University and at the Vaccine Research Center at the NIH before he came to Seattle. He has trained and directly mentored numerous pre- and post-doctoral researchers in flow cytometry and is an invaluable resource for our faculty and trainees that utilize flow cytometry in their research.

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Janet Englund, MD

Professor of Pediatric Infectious Diseases, University of Washington
Affiliate Investigator, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch

Dr. Englund is a Professor of Pediatric Infectious Diseases. Her research interest is the impact of respiratory viruses, with particular emphasis on viral dynamics in children and adults with underlying immunosuppressive conditions. She has a strong training record as shown by two post-doctoral fellows who have received K-23 awards and one with a likely fundable score. She has worked collaboratively in clinical trials sponsored by NIH/NIAID and industry to assess new and old vaccines and improve viral diagnosis in infants, immunocompromised hosts of all ages, Native Americans, children in developing countries, and pregnant women. In the immunocompromised population, she has conducted productive studies of the epidemiology, prevention and treatment of respiratory viral disease due to RSV, influenza virus, rhinovirus (RhV), and human metapneumovirus, as well as respiratory viral diagnosis and long-term outcomes in immunocompromised patients of all ages. Currently, she is working with trainees to establish the importance of viral load in respiratory tract symptoms in children, and collaborating to study new vaccines and antiviral therapies against multiple respiratory viruses.

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David N. Fredricks, MD

Director, Infectious Diseases Fellowship Training Program; Professor of Allergy and Infectious Diseases and Medicine, University of Washington Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutchinson Cancer Research Center Adjunct Professor of Microbiology, University of Washington

Dr. Fredricks is an infectious disease physician, microbiologist, and molecular biologist with more than 20 years of research experience. He has led a research team at the Fred Hutchinson Cancer Research Center and the University of Washington for the last 15 years that has focused on the study of human microbial communities using both cultivation-independent molecular methods (such as PCR and FISH), and *in vitro* cultivation approaches. The lab's goal is to advance our understanding of how the indigenous microbiota impacts human health, and to use this knowledge to develop new diagnostic and therapeutic tools. The Fredricks lab has also used novel cultivation approaches for laboratory propagation of fastidious human-associated bacteria. They have now extended these tools to study the microbiota in patients undergoing hematopoietic cell transplantation. They have also developed molecular diagnostic tests for the detection and identification of fungal pathogens in the immunocompromised host, and Dr. Fredricks has participated in multicenter studies evaluating diagnostics and treatments for fungal infections. Dr. Fredricks has mentored over 30 undergraduate students, graduate students, postdoctoral fellows, and junior faculty.

Khot PD, Ko DL, Hackman RC, **Fredricks DN**. Development and optimization of quantitative PCR for the diagnosis of invasive aspergillosis using

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Michael Gale, Jr., Ph.D.

Professor of Immunology University of Washington Adjunct Professor of Microbiology and Global Health, University of Washington Director, Center for Innate Immunity and Immune Disease, University of Washington Co-Director, Center for Emerging and Re-emerging Infectious Diseases, University of Washington Affiliate Investigator, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch

Dr. Gale is a professor of Immunology, and is a formally trained immunologist and virologist with expertise in studies of virus/host interactions, innate immunity, and immune signaling of RNA viruses. His research is focused on understanding the innate immune response to infection by emerging RNA viruses, including Ebola Virus, Zika Virus, West Nile Virus, Hanta Virus, Influenza Viruses, and others, and leveraging this information to build improved vaccines, vaccine adjuvants, and antiviral therapeutics. The Gale laboratory is currently developing and testing two novel vaccines for protection against Zika virus, and is developing a new class of innate immune-targeted antiviral drugs for broad spectrum application to enhance vaccine immunity and to treat virus infection through induction of innate antiviral immunity. These new therapeutics will improve

global health by providing effective treatment against RNA virus infection.

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Adam Geballe, MD

Member, Human Biology and Clinical Research Divisions, Fred Hutch
Professor of Allergy and Infectious Diseases and Medicine, University of Washington
Adjunct Professor of Microbiology, University of Washington

Dr. Geballe is a Full Member at Fred Hutch and a Professor of Medicine at the UW. He is trained in medicine and molecular virology and his research has focused on gene specific and general translational control mechanisms used by viruses to facilitate replication and to overcome host defenses. His earlier work centered on gene specific translational control mechanisms used by human CMV. Currently, he is using the model poxvirus, vaccinia, as well as multiple primate CMVs to uncover the molecular mechanism and evolutionary trajectories through which large DNA viruses adapt to host defenses such as the broadly active host defense pathway mediated by the double-stranded RNA sensor Protein Kinase R.

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Peter Gilbert, PhD

Member, Vaccine and Infectious Disease and Public Health Sciences Divisions, Fred Hutch
Head, Biostatistics, Bioinformatics and Epidemiology Program, Fred Hutch
Research Professor of Biostatistics, University of Washington

Dr. Peter Gilbert is a biostatistician with 20 years of experience in the design and analysis of randomized clinical trials for preventive vaccines against HIV, malaria, dengue, and other pathogens; as well as for MTCT prevention and antiretroviral therapies. Through his work as co-PI of the statistical data management center (SDMC) for the HIV Vaccine Trials Network (HVTN) since 2004 and PI since 2011, this research has centered on the design and analysis of HIV vaccine efficacy trials, for which Dr. Gilbert has developed innovative statistical methods, and led or helped lead the analysis of the 6 HIV vaccine efficacy trials that have been conducted. In addition, Dr. Gilbert has led the statistical sieve analysis of HIV genomic sequences in several HIV vaccine efficacy trials, for assessing how vaccine efficacy to prevent HIV infection varies with pathogen genomics. Dr. Gilbert was elected a Fellow of the American Statistical Association for his outstanding contributions in biostatistical research relevant to HIV vaccine efficacy trials by leading study design, analysis, and statistical methods development, especially in the areas of surrogate endpoint/correlates of protection

evaluation and sieve analysis of pathogen sequences, conducted within the fields of semiparametric inference, survival analysis, and causal inference. Dr. Gilbert's research has been published in top journals including *Annals of Applied Statistics*, *Annals of Statistics*, *Biometrics*, *Biometrika*, *JAMA*, *JASA*, *Lancet*, *Statistical Science*, *Nature*, *NEJM*, and *Science Translational Medicine*. Dr. Gilbert's public health service includes chairing Data Safety Monitoring Boards and membership on advisory panels for groups conducting vaccine research, the NIH study section AIDS and Related Research Integrated Review Group (2004-2008), and the FDA's Advisory Committee for Vaccines and Related Biological Products (VRBPAC, 2008-2012). For his whole career at the University of Washington Dr. Gilbert has been a very active advisor of biostatistics doctoral students on research topics emerging within vaccine efficacy trials. Dr. Gilbert seeks to optimize interdisciplinary research of the BBE Program including statisticians, bioinformaticians, computational immunologists and virologists, computer scientists, infectious disease epidemiologists, and dynamical modelers.

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Theodore Gooley, PhD

**Member, Clinical Research Division, Fred Hutch
Director, Clinical Biostatistics Program, Fred Hutch
Director, Biostatistics Shared Resource, Fred Hutch**

Dr. Gooley is a Full Member at Fred Hutch, where he has been a biostatistician in the Clinical Research Division for the past 24 years. Dr. Gooley's activities within the CRD include the design and analysis of experiments and clinical trials in HCT as well as the analysis of retrospective data in the field of HCT. He is a highly productive investigator with over 270 publications in peer-reviewed journals, many of these with fellows within VIDD and the CRD through various training grants. Access to competent statistical support is essential for both clinical and laboratory investigators and Dr. Gooley will be available to provide this support. In addition, he teaches a course to our fellows on the fundamentals of biostatistics and clinical trials.

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Alex Greninger, MD, PhD

**Assistant Professor of Laboratory Medicine,
University of Washington
Associate Director, Clinical Virology and
Retrovirology Laboratories, University of
Washington/Fred Hutch**

Affiliate Investigator, Vaccine and Infectious Disease Division, Fred Hutch

Dr. Greninger is an Assistant Professor of Laboratory Medicine and Associate Director of the clinical virology laboratories with broad training in clinical pathology, virology, epidemiology, and immunology. He has experience in metagenomics for clinical diagnostics, genomics and proteomics of viral infections, and bacterial genomics, with a slant in his basic science laboratory toward mechanisms of replication of picornaviruses, paramyxoviruses, and herpesviruses. Dr. Greninger is also interested in enhancing the clinical laboratory's ability to help patients, and he helps run the virology specialty labs for the AIDS Clinical Trial Group and HIV Vaccine Trial Network. The clinical laboratory is a source of abundant data, providing a wealth of opportunity for research.

Thomas Hawn, MD, PhD

Professor of Allergy and Infectious Diseases and Medicine, University of Washington

Dr. Hawn is a Professor of Medicine at UW. He studies the innate immune response to intracellular pathogens. He uses a combination of molecular, cellular, and human genetic techniques to examine the genetic basis and mechanisms of human susceptibility to infectious diseases. His research includes gene function studies that are utilized in conjunction with human genetic analyses of single nucleotide DNA polymorphisms in innate immune response genes in subjects with different infections. Since establishing his laboratory in 2005, he has been the primary mentor for 11 post-doctoral fellows and a co-mentor for 2 post-doctoral fellows and 2 pre-doctoral students with collaborators in Vietnam and South Africa. He has mentored 8 previous fellows who transitioned to junior faculty positions including 6 with NIH K awards.

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Joshua A Hill, MD

**Assistant Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch
Assistant Professor of Allergy and Infectious Diseases and Medicine, University of Washington**

Dr. Hill is an Assistant Member at the Fred Hutch and an Assistant Professor at the UW. His research interest focuses on clinical and translational investigations relating to human herpesvirus 6 (HHV-6) infections in immunocompromised hosts, with a focus on disease associations, risk stratification, and diagnostic strategies. This opportunistic pathogen is frequently identified in hematopoietic cell transplantation (HCT) recipients but is poorly understood. Dr. Hill is also involved in studies involving other DNA viruses that frequently reactivate in immunocompromised patients. His combined experiences provide a strong foundation to serve as a junior mentor. He has institutional support from the University of Washington (UW) and Fred Hutchinson Cancer Research Center (Fred Hutch), which will provide ample resources to facilitate mentoring of fellows and post-doctoral trainees.

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Keith Jerome, MD, PhD

Member, Vaccine and Infectious Disease Division, Fred Hutch
Professor of Laboratory Medicine, University of Washington
Director, Molecular Virology Laboratory, University of Washington

Dr. Jerome is a Professor of Virology and the Director of the Molecular Virology lab at the UW as well as a Full Member at Fred Hutch. His academic and clinical work focuses on the diagnosis of viral infections, and the development of gene therapy approaches to the cure of chronic viral infections. As head of the Molecular Diagnostic Lab, he is an essential collaborator and mentor for many projects and trainees. He has successfully trained undergraduate students, graduate students, as well as postdoctoral scientist and fellows.

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Christine Johnston, MD, MPH

Associate Professor of Allergy and Infectious Diseases and Medicine, University of Washington
Associate Program Director, Infectious Diseases Fellowship Training Program, University of Washington
Affiliate Investigator, Vaccine and Infectious Disease Division, Fred Hutch

Dr. Johnston is an infectious disease physician with over 10 years of experience conducting clinical research to study chronic viral infections, with a focus on herpesvirus. Her research focuses on the natural history and pathobiology of herpes simplex virus (HSV) infections, with the ultimate goal of creating new strategies to prevent and treat HSV. Her studies enroll participants into intensive specimen collection protocols to understand immunologic and virologic factors that are associated with variable clinical phenotypes of HSV infection. She works closely with a multidisciplinary group of laboratory and biostatistics colleagues. As Associate Program Director of the ID Fellowship, she has experience mentoring fellows with a variety of interests and career paths.

Johnston C, Saracino M, Kuntz S, Magaret A, Selke S, Huang M, Schiffer JT, Koelle DM, Corey L, Wald A. Standard-dose and high-dose antiviral therapy for short episodes of genital HSV-2 reactivation: Three randomized, open-label, cross-over trials. *Lancet*

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David Koelle, MD

Professor of Allergy and Infectious Diseases and Medicine, University of Washington

Adjunct Professor of Global Health and Joint Professor of Laboratory Medicine, University of Washington

Affiliate Investigator, Vaccine and Infectious Disease Division, Fred Hutch

Affiliate Investigator, Benaroya Research Institute

Dr. Koelle is a Professor of Medicine at UW and an affiliate researcher at Fred Hutch and Benaroya Research Institute with a laboratory program in viral immunology. He has been a successful mentor of both pre-doctoral and post-doctoral MD and PHD scientists since joining the faculty in 1997. His lab is interested in studies of the immune responses to infections, pathogen genetic variation, and the relationship between host genomics and infection severity. Pathogens include HSV types 1 and 2, VZV, human herpesvirus 6, vaccinia, *Mycobacterium tuberculosis*, and Merkel cell polyoma virus (MCPyV). His specific expertise is in the use of genomic libraries and genome-spanning ORF sets to interrogate CD8 and CD4 T-cell responses to a very high level of definition. Candidate HSV-1 and HSV-2 vaccine candidates have been identified, and some have been

studied in mice and are poised to enter phase I trials. His lab is also decoding the T cell response to MCPyV to assist cancer therapy. A specific focus of the lab has been measuring cellular immunity at sites of infection, such as skin, the female genital tract, the cornea, trigeminal ganglia, and tumor biopsies. Newer initiatives include studies of T-cell diversity using regular and deep sequencing of T-cell receptor hypervariable regions, expression of recombinant T-cell receptors, studies of HSV-1 and HSV-2 diversity at the DNA level, and detailed study of long-term T-cell memory decades after pathogen exposure.

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Wendy Leisenring, ScD

Member, Clinical Research and Public Health Divisions, Fred Hutch

Dr. Leisenring is a member of the Clinical Biostatistics faculty at Fred Hutch, where she has collaborated with clinical scientists for more than two decades. Her work encompasses a variety of study types, including prospective and retrospective cohort studies and clinical trials, for which she plays a key role in design and analyses. Within the HCT domain, her projects span a

wide range of topics, including infectious disease diagnosis, epidemiology, treatment, prevention and detection of long-term outcomes after HCT. Dr. Leisenring also leads the statistical center for the Childhood Cancer Survivor Study, which includes more than 20,000 survivors being studied for late effects of their cancer treatment. Dr. Leisenring is an essential resource to research fellows at the Fred Hutch while they work on their research projects; she provides mentoring on the collaborative process of working together with a statistician, formulating hypotheses, designing studies, gathering relevant data and carrying out analyses to answer compelling questions.

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Ajit Limaye, MD

Professor of Medicine and Laboratory Medicine, University of Washington
Director, Solid Organ Transplant Infectious Disease Program, University of Washington
Affiliate Investigator, Vaccine and Infectious Disease Division, Fred Hutch

Dr. Limaye is the Director of Solid Organ Transplant Infectious Disease Program. His research focuses on viral infections in transplantation, with particular emphasis on the epidemiology and management of CMV, BK virus, and respiratory viruses. Prior to becoming the Director of SOT ID he served as co-Director of the Clinical Microbiology laboratory at UW. He has a strong track of record in clinical trial conduct, including trials of all phases and observational studies. He is the PI of an investigator-initiated multicenter NIH supported randomized trial of CMV prevention in critically ill patients and a trial of CMV prevention strategies in liver transplant recipients. He has a long track record of training undergraduates, graduate students and fellows since 2000. Dr. Limaye will be a co-leader of Track 1.

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Catherine Liu, MD

Associate Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch
Associate Professor of Allergy and Infectious Diseases and Medicine, University of Washington
Director, Antimicrobial Stewardship and Outpatient Antimicrobial Therapy Programs, Seattle Cancer Care Alliance

Dr. Liu serves as Director of the Antimicrobial Stewardship and Outpatient Parenteral Antimicrobial Therapy Programs at the Seattle Cancer Care Alliance. She joined the faculty at Fred Hutch and UW in 2017 from the University of California, San Francisco where she served on faculty for 9 years. Her research focuses on antimicrobial stewardship and infection prevention among cancer and hematopoietic cell transplant

patients. Current projects aim to identify opportunities for improved antimicrobial utilization among cancer patients including areas such as upper respiratory tract infections, febrile neutropenia, and sepsis. She also has an interest in clinical guideline development to improve patient care and standard practice and has participated in guideline development on a local and national level. She has successfully mentored numerous students, residents and fellows on a variety of projects.

Liu C, Schwartz BS, Vallabhaneni S, Nixon M, Chin-Hong PV, Miller SA, Chiu C, Damon L, Drew WL. Pandemic (H1N1) 2009 infection in patients with hematologic malignancy. *Emerg Infect Dis.* 2010; 16(12):1910-7. doi: 10.3201/eid1612.100772

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Amalia Magaret, PhD, MS

Research Professor of Pediatrics, University of Washington

Adjunct Research Professor of Biostatistics, University of Washington

Affiliate Investigator, Vaccine and Infectious Disease and Public Health Sciences Divisions, Fred Hutch

Dr. Magaret conducts research on herpesviruses and HIV, specializing in clinical and immunological determinants of HSV disease severity and transmission. She also develops novel statistical methods appropriate for design and implementation of viral shedding studies and for analysis of time-to-event data. She's involved in infectious disease studies in the immunocompromised host by

analysing the different risk factors for the acquisition of infections between the HIV-infected host and HIV-uninfected persons. Dr. Magaret has collaborated with many of the training program researchers examining respiratory, digestive and systemic infections among HIV-infected persons in Kenya, Uganda, Peru and the United States.

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Steven Pergam, MD, MPH

Associate Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch

Associate Professor of Allergy and Infectious Diseases and Medicine, University of Washington
Director, Infection Prevention, Seattle Cancer Care Alliance

Dr. Pergam is an Associate Member in the Vaccine and Infectious Disease and Clinical Research Divisions of Fred Hutch and an Associate Professor at the UW. He also serves as Director of Infection Prevention at the FHCRC/Seattle Cancer Care Alliance. His current research interests involve infection prevention in immunosuppressed hosts. Dr. Pergam's research group focuses on the epidemiology of major pathogens, antimicrobial stewardship, and on the development of novel prevention strategies for community and healthcare-associated infections in cancer and hematopoietic cell transplant patients. He is specifically interested in the interplay between the immune response, the microbiome, bacterial and viral infections in the respiratory and gastrointestinal systems, and their

association with inflammatory complications (e.g. GVHD, mucositis). Dr. Pergam's research group has developed novel data and expertise in patient quality and safety in high-risk immunosuppressed patients. Dr. Pergam has a long track record of mentorship and expertise in epidemiology, clinical trial design, and statistical analyses.

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Warren T. Phipps, MD, MPH

Assistant Member, Vaccine and Infectious Disease Division, Fred Hutch
Medical Director, Hutchinson Cancer Research Institute - Uganda
Assistant Professor of Allergy and Infectious Diseases and Medicine, University of Washington

Over the last ten years, Dr. Phipps has served as the Medical Director of the Uganda Cancer Institute / Hutchinson Center Cancer Alliance (UCI/HCCA) and oversees the program's research activities on infection-related cancers in Kampala, Uganda. His research focuses on HIV-associated malignancies, with a particular emphasis on human herpesvirus-8 (HHV-8) virology and the pathogenesis of Kaposi sarcoma (KS), the most common HIV-associated malignancy worldwide. Dr. Phipps also studies the impact of HIV and antiretroviral therapy on cancer incidence and outcomes in Uganda, and provides clinical care to HIV-infected patients at the Uganda Cancer Institute.

Phipps W, Ssewankambo F, Nguyen H, Saracino M, Wald A, Corey L, Orem J, Kambugu A, Casper C. Gender differences in clinical presentation and outcomes of epidemic Kaposi sarcoma in Uganda. *PLoS One*. 2010;5(11):e13936. doi: 10.1371/journal.pone.0013936 PMID: PMC2980479.

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Bender Ignacio R, Gadrshenas M, Low D, Orem J, Casper C, **Phipps W**. HIV status and associated clinical characteristics among adult patients with cancer at the Uganda Cancer Institute. *J Glob Oncol*. 2018;4:1-10. doi: 10.1200/JGO.17.00112 PMID: PMC6181185.

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Stanley Riddell, MD

Member, Clinical Research Division, Fred Hutch
Professor of Medical Oncology, University of Washington

Adjunct Professor of Immunology, University of Washington
Head, Research and Development, Lyell Immunopharma

Dr. Riddell is an immunologist with interest in the specificity and function of human T cell responses to pathogens and malignancies. He has performed pioneering work in the development and clinical application of adoptive T cell therapy for human CMV infection, and for malignancies including acute and chronic leukemia, and lymphoma. Research projects involve the discovery of target antigens for T cell therapy, and the design of T cell and synthetic chimeric antigen receptors that can be introduced into T cells to confer tumor specificity or alter the tumor microenvironment. Recent work in the lab has been directed at defining intrinsic qualities of memory T cells that enable life-long memory to pathogens and superior persistence and efficacy after adoptive transfer, and at identifying barriers to tumor eradication that can be targeted with combination therapies. He has trained over 25 postdoctoral fellows over the past 15 years, including several individuals who have subsequently established their own successful independent programs in infectious disease and cancer immunology. He has served as both as primary mentor and on the mentoring committee for several K award and numerous foundation award recipients. Dr. Riddell will lead Track 2.

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Joshua Schiffer, MD, MSc

Associate Member, Vaccine and Infectious Disease and Clinical Research Divisions, Fred Hutch
Associate Professor of Allergy and Infectious Diseases and Medicine, University of Washington

Dr. Schiffer is an Associate Member in VIDD at the Fred Hutch and Associate Professor at UW. His scientific program bridges laboratory-based studies with mechanistic mathematical models to capture dynamic interactions between viral pathogens and the human immune system. He is R01 supported and has an outstanding publication and mentoring record. A major focus has been on the complex kinetics of HSV-2 reactivations in the genital tract. Current research areas include modelling: simulation of antiviral therapy clinical trials for dose optimization; strategies to achieve cure of HIV; approaches to tissue-resident T-cells within three-dimensional microenvironments; and shifts in the human microbiome and viral dynamics in childhood human herpes virus infections.

Schiffer JT, Swan DA, Magaret A, Corey L, Wald A, Ossig J, Ruebsamen-Schaeff H, Stoelben S, Timmler B, Zimmerman H, Melhem MR, Van Wart SA, Rubino CM, Birkmann A. Mathematical modeling of herpes simplex virus-2 suppression with pritelivir predicts trial outcomes. *Sci Transl Med*. 2016;11(6):e0155124. doi: 10.1371/journal.pone.0155124 PMID: PMC4902308

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Justin Taylor, PhD

Assistant Member, Vaccine and Infectious Disease, Fred Hutch

Affiliate Assistant Professor of Global Health and Immunology, University of Washington

Most vaccines provide protection by inducing the production of antibodies that can bind to a pathogen and block infection. Unfortunately, there are many dangerous viruses in which the development of a vaccine has been elusive despite decades of intense research. These failures highlight gaps in knowledge about the type of cell that can produce antibodies, the B cell. The Taylor lab aims to inform vaccine design by gaining a deeper understanding about the mechanisms limiting the generation of a protective B cell response. To do this, we study B cell responses in humans and murine models beginning with the rare pathogen-specific “naïve” B cells present prior to the vaccination using an enrichment method we recently developed. These approaches allow for the phenotypic and functional analysis of naive and activated B cells that target protective epitopes on candidate vaccine antigens for important viral and bacterial infections.

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Cameron Turtle, MD

Associate Member, Clinical Research Division; Anderson Family Endowed Chair for Immunotherapy, Fred Hutch

Associate Professor of Medical Oncology, University of Washington

Dr. Turtle is an Associate Member in the Clinical Research Division at Fred Hutch and an Associate Professor in the Division of Oncology at the UW. His laboratory is focused on understanding the characteristics of distinct subsets of human CD8+ memory T cells, their potential utility for tumor immunotherapy, and their role in immune reconstitution and GVHD after HCT. His lab has extensive expertise in the isolation, culture, genetic modification, and propagation of conventional and innate-like T cells, and is highly proficient in the phenotypic, transcriptional, and functional analysis of human T cell subsets in healthy individuals and cancer patients. As PI and Investigational New Drug (IND) Sponsor of an ongoing clinical trial to evaluate therapy of CD19+ B cell malignancies by adoptive transfer of central memory CD8+ T cells that are lentivirally engineered to express a CD19-specific chimeric antigen receptor (CAR) he can offer clinical, laboratory and regulatory experience to trainees (Tracks 2 and 3).

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Alpana Waghmare, MD

Assistant Professor of Pediatrics, University of Washington
Associate, Vaccine and Infectious Disease Division, Fred Hutch

Dr. Waghmare's research is in the field of translational infectious diseases, with a particular focus on respiratory viral infections. Her interest in viral infections in immunocompromised hosts stems from her experiences as a clinician, where she witnessed the impact of respiratory viral infections in vulnerable populations. Dr. Waghmare translated her interest in respiratory viruses into clinical research projects including the investigation of risk factors for RSV-associated mortality and the use of a novel antiviral for parainfluenza virus infection. While these pathogens, she began to appreciate the impact of an often-overlooked respiratory pathogen, human rhinovirus. Dr. Waghmare's current research interests involve evaluating biomarkers for disease severity in HCT recipients with rhinovirus infection and she been awarded a K23 award from the National Institute of Allergy and Infectious Diseases to pursue this work.

Waghmare A, Campbell AP, Xie H, Seo S, Kuypers J, Leisenring W, Jerome KR, Englund JA, Boeckh M. Respiratory syncytial virus lower respiratory disease in hematopoietic cell transplant recipients: viral RNA detection in blood, antiviral treatment, and clinical outcomes. *Clin Infect Dis*. 2013;57(12):1731-1741. doi: 10.1093/cid/cit639 PMID: PMC3840404

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Anna Wald, MD, MPH

Professor of Allergy and Infectious Diseases and Medicine, Epidemiology and Laboratory Medicine, University of Washington
Member, Vaccine and Infectious Disease Division, Fred Hutch
Head, Allergy and Infectious Diseases Division, University of Washington
Director, Virology Research Clinic, University of Washington

Dr. Wald is head of the UW Allergy and Infectious Diseases Division and the Director of the UW Virology Research Clinic. Her clinical research has centered on HSV-2 infections, but also includes other viral pathogens as well as vaccine studies. Her current support includes a renewal of the NIAID K24 Mentor Award, a Program Project Grant on HSV clinical epidemiology, and Sexually Transmitted Infections Clinical Research Center which is investigating the interactions between genital microbiome and STI's. In addition to clinical trials of candidate therapeutic HSV-2 vaccines, she is initiating a trial of HPV vaccine for high grade neoplasia of the genital and anal tract in women and men. She has been a colleague and a collaborator of Dr. Boeckh for 2 decades, and they have successfully co-mentored many trainees. Dr. Wald will be a mentor and also serve on the Internal Advisory Committee.

Wald A, Timmler B, Magaret AS, Warren T, Tyring S, Johnston C, Fife K, Selke S, Huang ML, Stobernack HP, Zimmermann H, Corey L, Birkmann A, Ruebsamen-Schaeff H. Pritelivir compared to Valacyclovir for suppression of genital HSV-2 shedding and lesions: a randomized clinical trial. *JAMA*. 2016;316(23):2495-2503. doi: 10.1001/jama.2016.18189 PMC Journal – In Process

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Danielle Zerr, MD, MPH

**Professor of Pediatrics, University of Washington
Affiliate Investigator, Vaccine and Infectious
Disease Division, Fred Hutch**

Dr. Zerr is a Professor of Pediatric Infectious Diseases and Division Chief of Pediatric Infectious Disease at Seattle Children's Hospital. She is an Infectious Disease scientist with training in epidemiology, a successful track record in mentoring, and experience in leading clinical research focused on human herpesvirus 6 (HHV-6) infection and healthcare-associated infections. Her expertise and experience makes her well-qualified to serve as the leader of Track 4. She has been the PI or co-investigator of several NIH-, university-, and industry-sponsored grants, including an NIH career development award and R01s focused on the epidemiology of HHV-6, and healthcare associated infections. She is a productive investigator that has conducted multiple retrospective as well as several large prospective clinical studies, a portion of which have involved immunocompromised populations.

Zerr DM, Fann JR, Breiger D, Boeckh M, Adler A, Xie H, Delaney C, Huang M, Corey L, Leisenring WM. HHV-6 reactivation and its effect on delirium and cognitive functioning in hematopoietic cell transplantation recipients. *Blood.* 2011;117(19):5243-49. doi: 10.1182/blood-2010-10-316083 PMID: PMC310954

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