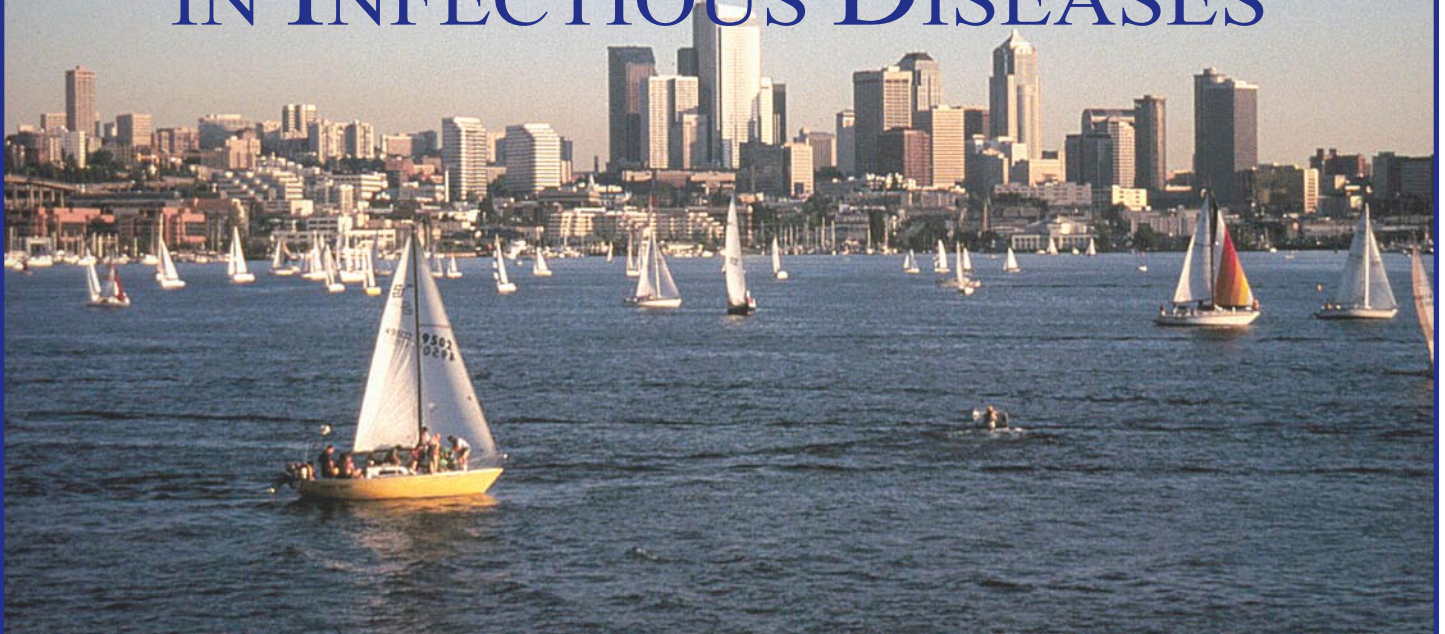


# 1ST SUMMER INSTITUTE IN STATISTICS AND MODELING IN INFECTIOUS DISEASES



June 15 - July 1, 2009

UNIVERSITY *of* WASHINGTON  
Seattle, Washington

<http://depts.washington.edu/sismid09>

SISMID  
2009

Sponsored by:



DEPARTMENT OF BIostatISTICS  
SCHOOL OF PUBLIC HEALTH  
UNIVERSITY *of* WASHINGTON

Supported by the National Institutes of Health

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# Administrative Details

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## General Information

The 2009 Summer Institute in Statistics and Modeling in Infectious Diseases will be held in the South Campus Center of the University of Washington in Seattle, Washington. A map showing this location is on the **Institute website**: <http://depts.washington.edu/sismid09>.

The Institute consists of a series of two-and-a-half day workshops designed to introduce infectious disease researchers to modern methods of statistical analysis and mathematical modeling and to introduce statisticians and mathematical modelers to the statistical and dynamic problems posed by modern infectious disease data. Prerequisites are minimal, and the modular nature of the Institute enables participants to design a program best suited to their backgrounds and interests. Most participants will likely take two or three modules.

Individuals attending the Institute will receive certificates of course completion in recognition of their participation.

In 2009 there will be three concurrent Institutes in Seattle and a European Institute in Liège, Belgium. Details about the Summer Institute in Statistical Genetics in Seattle, June 15-July 1; the Summer Institute in Public Health Genomics in Seattle, June 22-26; and the European Institute in Statistical Genetics in Liège, August 31-September 9, are available online via the Summer Institutes website: <http://www.biostat.washington.edu>. Registration for all four Institutes is available only online via each Institute's website. Links to the individual Institutes are listed via the Summer Institutes website: <http://www.biostat.washington.edu>.

**Registration for the Summer Institute in Statistics and Modeling in Infectious Diseases is available only online at the Institute website: <http://depts.washington.edu/sismid09>.**

The Summer Institute in Statistics and Modeling in Infectious Diseases modules are timed such that participants may also register for modules for the Summer Institute in Statistical Genetics at <http://sisg.biostat.washington.edu>.

*SISMID participants are invited to attend a Symposium in Honor of Elizabeth Thompson on Saturday, June 27, 2009.*

## Registration Deadlines and Fees

Registration fee per module: \$650 (USD); Early-bird rate: \$550 (USD).

Reduced academic, government and not-for-profit organization fee per module: \$500 (USD); Early-bird rate: \$400 (USD).

**Early-bird deadline is Monday, May 18, 2009. Participation in any module cannot be guaranteed for registrations received after Monday, May 18, 2009.**

Registration fees cover tuition, course materials, coffee breaks and networking events. Meals, travel and lodging are not covered. No textbooks are required or supplied, but books recommended as background reading are listed in the module descriptions.

**Refund Policy:** A \$100 processing fee will be deducted from refunds requested after Monday, May 25, 2009. No refunds will be processed after Monday, June 8, 2009.

Payment can be made with all major credit cards online via a secure server. Mailed payments to the mailing address shown on the next page can be made with a purchase order (U.S. companies and organizations only) or by check or money order in U.S. dollars drawn on a U.S. bank. Checks should be made payable to the University of Washington. For wire-transfers, please refer to your Registration Invoice for instructions.

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# Administrative Details

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## Scholarships

Some registration-fee and travel scholarships are available for students and post-doctoral fellows. Applications are due on or before **Monday, April 13, 2009**, and recipients will be notified by Monday, April 20, 2009. Applicants should send a letter explaining their reason for wishing to attend the Institute, the Registration Cover Sheet listing the modules they wish to attend, a one-page CV, and a letter from an academic advisor to the mailing or email addresses shown below. Students may apply to both the Summer Institute in Statistics and Modeling in Infectious Diseases and the Summer Institute in Statistical Genetics for support for particular modules. They should submit separate applications to both Institutes, stating in both applications why they are interested in that mix of modules. **Applicants should also register for the modules and check the “Yes” button to the question: “Are you applying for a Summer Institute scholarship?” so that payment will not be required at time of registration.**

## Computing

Most modules will incorporate computing and participants are encouraged to bring laptop computers with them. They will have free online access while they are on the University of Washington campus. Participants will receive USB-drives with copies of software and datasets when they arrive at the Institute. It is suggested, however, that participants follow the online instructions at the Institute website to download software and data before they arrive.

## Lodging Accommodations

A list of local hotels offering special rates to participants is on the Institute website along with information for requesting dormitory accommodation.

## Conference Mailing Address

Summer Institute in Statistics and Modeling in Infectious Diseases  
c/o University of Washington, Department of Biostatistics  
F-600 Health Sciences Building, 1705 NE Pacific Street  
Box 357232  
Seattle, WA 98195-7232





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# Instructors

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**Kari Auranen**

Senior Scientist  
Department of Vaccine  
National Institute for Health and Welfare, Finland  
University Lecturer  
Department of Mathematics and Statistics  
University of Helsinki, Finland

**Ivan Chan**

Senior Director, Clinical Biostatistics  
Merck Research Laboratories

**Dennis Chao**

Staff Scientist  
Fred Hutchinson Cancer Research Center

**John Drake**

Assistant Professor of Ecology  
University of Georgia

**Peter Gilbert**

Member, Fred Hutchinson Cancer Research Center  
Research Professor of Biostatistics  
University of Washington

**David M. Goldsman**

Professor, School of Industrial and Systems Engineering  
Georgia Institute of Technology

**M. Elizabeth Halloran**

Professor of Biostatistics, University of Washington  
Member, Fred Hutchinson Cancer Research Center  
Director, Summer Institute in Statistics and  
Modeling in Infectious Diseases

**Andreas Handel**

Assistant Professor of Epidemiology and Biostatistics  
University of Georgia

**Eddie Holmes**

Professor of Biology  
Eberly College of Science Distinguished Senior Scholar  
Center for Infectious Disease Dynamics  
Pennsylvania State University

**Michael G. Hudgens**

Associate Research Professor of Biostatistics  
University of North Carolina, Chapel Hill

**Stephanie Klopfer**

Associate Director, Scientific Staff  
Late Stage Clinical Biostatistics - Vaccines  
Merck Research Laboratories

**Philippe Lemey**

Department of Microbiology and Immunology  
Rega Institute, Catholic University Leuven, Belgium

**Ira M. Longini, Jr.**

Professor of Biostatistics, University of Washington  
Member, Fred Hutchinson Cancer Research Center

**Devan Mehrotra**

Senior Director, Clinical Biostatistics  
Merck Research Laboratories

**Lauren Ancel Meyers**

Associate Professor of Integrative Biology  
Associate Director of the Division of Statistics  
and Scientific Computation  
The University of Texas at Austin

**Vladimir Minin**

Assistant Professor of Statistics  
University of Washington

**Babak Pourbohloul**

Director, Division of Mathematical Modeling  
British Columbia Centre for Disease Control  
Assistant Professor of Health Care and Epidemiology  
University of British Columbia

**Thomas Richardson**

Professor of Statistics  
University of Washington

**Pejmani Rohani**

Professor of Ecology  
University of Georgia

**Paul G. Thomas**

Assistant Member of Immunology  
St. Jude's Research Hospital

**Kwok Tsui**

Professor, School of Industrial and Systems Engineering  
Georgia Institute of Technology

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# Modules

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## **Module 1: Infectious Diseases and Immunology**

Instructors: Andreas Handel and Paul Thomas

This module provides an introduction to infectious diseases, the main components of the immune system, and within-host infectious disease dynamics. Simple deterministic models of within-host dynamics are introduced. Basic concepts of infectious disease epidemiology, such as the basic reproductive number, serial interval, latent, incubation and infectious period, and their applications to within-host infection dynamics are discussed. The use of models to study within-host dynamics of intervention strategies, such as vaccines and drug treatment, are covered. Background reading: How the Immune System Works, by Sompayrac, L.M., Wiley-Blackwell, 3rd edition, 2008. Standard reference book: Janeway's Immunobiology, by Murphy, K.M., Travers, P. and Walport, M. Garland Science Publishing, 7th edition, New York and London, 2008.

## **Module 2: Mathematical Models of Infectious Disease**

Instructors: Pejmani Rohani and John Drake

This module covers the principles of deterministic mathematical models of infectious diseases. The focus is on dynamic models. The module will focus on the dynamics of susceptible-infected-recovered (SIR) models, and variants such as SI, SIRS, and SEIR models. Topics include different types of mixing patterns, theoretical results, optimization, and fitting of deterministic models to data. The module will cover modeling longitudinal data and temporal patterns of infectious diseases. Programming will be done in Matlab. Background Reading: Matt J. Keeling and Pejmani Rohani. Modeling Infectious Diseases in Humans and Animals. 2007. Princeton University Press.

## **Module 3: Probability and Statistical Inference**

Instructors: TBN

This course covers the laws of probability and methods of inference, including maximum likelihood, confidence intervals, and simple Bayes methods. Classical hypothesis testing topics, including type I and II errors, two-sample tests, and re-sampling methods, such as bootstrap and jack-knife are covered. Examples will be drawn from important infectious disease applications.

## **Module 4: MCMC Methods for Infectious Disease Studies**

Instructors: Kari Auranen, Elizabeth Halloran and Vladimir Minin

This module covers the use of Bayesian statistics and Markov Chain Monte Carlo methods with applications in infectious disease studies. Familiarity with the R statistical package or other computing language would be helpful. The first day includes an introduction to Bayesian statistics, Monte Carlo, and MCMC. Algorithms include Gibbs sampling and Metropolis-Hastings. Practical issues arising in applications are emphasized. It assumes the material in either Module 1 or Module 2, and Module 3.

## **Module 5: Design and Analysis of Vaccine Clinical Trials**

Instructors: Devan Mehrotra and Stephanie Klopfer

Topics including Phase I through Phase IV clinical trials will be covered. Topics include safety and immunogenicity, sample size calculation, target populations, different methods of analysis depending on the design of the study and type of data collected. This will cover statistical issues in all phases of vaccine development, including those pertaining to evaluation of immunogenicity, efficacy, and safety, as well as "bridging" trials and lot consistency trials. Assumes the material in either Module 1 or Module 2, and Module 3.

## **Module 6: Evaluating Indirect Effects of Vaccination**

Instructors: Elizabeth Halloran and Ira Longini

An overview of different effects of vaccines in populations will be covered. How different levels of information that can be collected influence the estimation of different vaccine effects will be presented. Topics include study designs for evaluating direct, indirect, total, and overall effects of vaccination and other interventions. Methods for evaluating indirect effects and population level effects of vaccination from observational studies and surveillance data will be considered. Group-randomized studies for evaluating population level effects will be presented. Topics include household-based studies or studies in other transmission units such as schools. Assumes the material in Module 1, Module 3 and Module 4.

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# Modules

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## **Module 7: Stochastic Simulation Methods for Infectious Diseases**

Instructors: Dave Goldsman, Dennis Chao, Kwok Tsui

The principles of infectious disease spread in populations will be covered, including population structure, natural history of the infectious agent, and assumed interventions. The course will discuss the basic elements of stochastic simulation, including the simulation process-interaction modeling world view, random variate generators, input modeling, analysis of simulation output, variance reduction techniques, and simulation optimization methods. These topics will be illustrated using the Reed-Frost and Greenwood models, as well as simulations involving influenza and cholera. Brief tutorials will be presented (i) showing how R can be used to analyze simulation data, and (ii) demonstrating Arena, a popular discrete-event simulation language, which allows for animations of disease propagation under various intervention strategies. Assumes the material in either Module 1 or Module 2. Familiarity with the R statistical package would be helpful, but not required.

## **Module 8: Evaluating Surrogates of Protection**

Instructors: Peter Gilbert and Ivan Chan

Topics include methods for determining immunological correlates of risk and surrogates of protection in vaccine studies. Approaches include regression models and methods of causal inference. Immunologic surrogates include serologic as well as cell mediated surrogates. Assumes the material in Module 1, Module 3, and Module 5.

## **Module 9: Inference for Graphs and Network Theory in Infectious Diseases**

Instructors: Babak Pourbohloul and Lauren Ancel Meyers

Topics include introduction to concepts of graph theory, including nodes, edges, shortest path, giant component, among others. Methods to estimate characteristics from a complete graph will be covered. Methods on how to model the spread of infectious disease on a contact network will be taught. The types of data necessary to infer graphs and the analysis of such data to understanding contact structures in populations will be covered. The software statnet will be demonstrated. Knowledge of R is assumed. Assumes material in Module 3. Module 5 is recommended.

## **Module 10: Causal Inference in Infectious Disease Epidemiology**

Instructors: Michael Hudgens and Thomas Richardson

This module provides an introduction to the potential outcomes approach to causal inference. Topics such as potential outcomes, underlying assumptions about the assignment mechanism, no interference between units will be covered. Approaches for observational studies, such as marginal structural models will be covered. Applications of causal inference in infectious diseases will include the relaxation of the no interference assumption, selection bias in postinfection outcomes, and surrogates of protection. Assumes material in Module 3, and preferably Module 5.

## **Module 11: Evolutionary Inference and Infectious Disease Phylodynamics**

Instructors: Eddie Holmes and Philippe Lemey

This module covers the use of phylogenetic and bioinformatic tools to analyze pathogen genetic variation and to gain insight in the processes that shape their diversity. The module focuses on phylogenies and how these relate to population genetic processes in infectious diseases. Approaches include sequence alignment, maximum likelihood and Bayesian phylogenetics and evolutionary hypothesis testing. Statistical inference that combines these models to reconstruct viral epidemic histories is also considered. The module will provide both theoretical lectures and practical courses. Assumes material in Module 1, Module 3 and Module 4.

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# Daily Schedule

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Time	Daily Activity
8:00 am – 8:30 am	Coffee (and Registration on Mondays)
8:30 am – 10:00 am	Class Session
10:00 am – 10:30 am	Break
10:30 am – 12:00 pm	Class Session
12:00 pm – 1:30 pm	Lunch (and Registration on Wednesdays)
1:30 pm – 3:00 pm	Class Session
3:00 pm – 3:30 pm	Break
3:30 pm – 5:00 pm	Class Session
5:00 pm – 6:00 pm	Networking (Mondays and Wednesdays)

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# Calendar

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Monday (8:30 am–6 pm)	Tuesday (8:30 am–5 pm)	Wednesday (8:30 am–noon)	Wednesday (1:30 pm–6 pm)	Thursday (8:30 am–5 pm)	Friday (8:30 am–5 pm)
June 15	June 16	June 17	June 17	June 18	June 19
Mod 1: Infectious Diseases and Immunology Mod 2: Mathematical Models of Infectious Diseases Mod 3: Probability and Statistical Inference			Mod 4: MCMC for Infectious Disease Studies Mod 5: Design and Analysis of Vaccine Clinical Trials		
June 22	June 23	June 24	June 24	June 25	June 26
Mod 6: Evaluating Indirect Effects of Vaccination Mod 7: Stochastic Simulation Methods for Infectious Diseases			Mod 8: Evaluating Surrogates of Protection Mod 9: Inference for Graphs and Network Theory in Infectious Diseases		
June 29	June 30	July 1			
Mod 10: Causal Inference in Infectious Disease Epidemiology Mod 11: Evolutionary Inference and Infectious Disease Phylodynamics					

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