

NEWS RELEASE

Media Contact: Tracey Peake, News Services, 919/515-6142 or
tracey_peake@ncsu.edu

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NC State Researchers Receive \$3.5 Million to Design Innovative Treatment Strategies for HIV Patients

FOR IMMEDIATE RELEASE

Researchers at North Carolina State University have received a \$3.5 million grant from the National Institute of Allergy and Infectious Disease (NIAID) to develop mathematical and statistical models that will aid in designing new treatment strategies for HIV patients.

The researchers hope that the grant will help them devise a mathematical model that can predict the best course of treatment for “acutely” infected HIV patients, or patients who have recently been infected with the virus.

Dr. Tom Banks, mathematics professor and director of NC State’s Center for Research and Scientific Computation (CRSC); Dr. Marie Davidian, professor of statistics and member of CRSC; Dr. Eric Rosenberg, clinician at Massachusetts General Hospital, professor at Harvard Medical School, and CRSC member; and Dr. Hien Tran, professor of mathematics, associate head of the Department of Mathematics, and CRSC member, received the five-year grant on July 1.

“Based on what we know about HIV, there is really no consensus on the best treatment for acutely infected individuals,” Davidian says. “The medical community needs to know how immediate drug therapy may affect the patient’s own ability to cope with the disease and the treatment itself down the line.”

When a patient is first infected with HIV, the amount of virus present in the bloodstream, or viral load, skyrockets. Current drug therapies can quickly bring that viral load down to a “set point,” or stable level. However, even without drug therapy, the patient’s viral load decreases to a set point over time, leading some researchers to wonder whether it’s best to allow a patient’s body to adapt to the virus naturally, or whether allowing the body to cope with acute infection, and thus “learn” the virus, actually damages the immune system beyond repair.

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In addition, HIV patients tend to develop drug resistance or reactions to the medications the longer they are treated, necessitating frequent “drug holidays.” So the question becomes not only whether to treat these patients immediately, but also, how long should each treatment interval last.

Fortunately, the researchers exploring these questions have data on their side: more than five years of patient treatment data from Dr. Rosenberg.

“The first step is to use existing data to define a mathematical model that can show us what happens to acutely infected patients when they are treated or not treated,” Banks says. “Then we extrapolate from the existing data using statistical methods, to see what the model predicts will happen under no treatment or under a given treatment interval. Based on the results, we can design a clinical trial to see if the data from actual patients match the predictions.”

The model takes into account a number of patient variables, such as viral load and how long they’ve been infected, which vary within the patient population. “Once we’re convinced that this model is accurate, we can then simulate virtual patients by combining it with a statistical model for the variation in the patient population in order to test treatment theories, to determine the most promising treatment times and durations for optimum results” Davidian says.

Eventually Rosenberg will run clinical trials with actual patients to test their results. If all goes well, the research could lead to a new approach for treating acutely infected HIV patients – one that takes personal variables into account for each patient and tailors treatment accordingly.

“It’s not a cure, but maybe it can improve the quality of treatment these patients receive,” Davidian says. “And this work has implications for a number of other diseases that involve compromised immune systems. We hope that this mathematical-statistical modeling approach will be a step toward the current goal of modern medicine – personalized treatment of diseases.”