

APPLICANT: CHRISTINA S. HAYES, GETTYSBURG COLLEGE
MENTOR: EILEEN STILLWAGGON, GETTYSBURG COLLEGE

Because I am not a graduate student or postdoc, but rather a new Assistant Professor of Mathematics, my application is a bit unusual. In lieu of a mentorship letter, I am attaching below Eileen Stillwaggon's letter of interest. Eileen is an extra-departmental mentor of mine at Gettysburg College. Please see in the next-to-last paragraph Eileen's statement about our working together.

**Statement of Interest and Commitment Prof. Eileen Stillwaggon
Gettysburg College**

The DIMACS-SACEMA Advanced Study Institute at AIMS is a perfect match for the preparation that I need to continue my work on HIV/AIDS and endemic diseases. I decided some time ago to take off from teaching for the 2007-2008 academic year in order to retool in mathematical modeling of disease dynamics. Mine is not the sort of application that is anticipated in the DIMACS announcement, but the aims of the program are met in the work I will complete in the coming year and beyond.

I am an economist, and my research has focused on poverty, underdevelopment, and endemic diseases, summarized in my book published by Rutgers University Press in 1998. For the past eight years, I have been researching the relationships between HIV/AIDS and endemic tropical diseases. In a number of articles in refereed journals and in a book published in 2006 by Oxford University Press, I have proposed an explanation for the divergence in AIDS epidemics between different regions. Global AIDS policy relies too heavily on behavioral interventions, with little empirical evidence on their effectiveness, and has virtually ignored the biological interactions among diseases.

My work has brought together the scientific evidence on the role that soil-transmitted helminths, malaria, malnutrition, schistosomiasis, and other endemic conditions play in increasing the risk of HIV transmission by suppressing immune response and increasing viral load. I have presented my research in an oral session at the XVI International AIDS Conference in Toronto in 2006 and in a poster session in Bangkok in 2004, at meetings of the International AIDS Economics Network in Bangkok in 2004 and Durban in 2000, at the World Health Organization in Geneva in 2005, at the London School of Economics in 2005, at Harvard School of Public Health in 2006, at Harvard Medical School in 2006, and at many other seminars and conferences. My work on the interactions among diseases has received increasing support over the past year. Key elements of my argument have been confirmed in recent articles in *Science* (on malaria and HIV), *AIDS* (on genital schistosomiasis and AIDS), and *Lancet* (on the secondary role of differences in sexual behavior).

To redirect the allocation of funds for HIV prevention and treatment and other endemic diseases, I want to develop a more complex model of HIV transmission. Current methods of cost-effectiveness analysis are too simplistic to estimate the costs and benefits of multiple interventions for interacting diseases. Moreover, health economists rely on simplistic models of disease causation. Consequently, we are at risk of throwing away first-line antiretroviral therapy (ART) because the epidemiological models and cost-effectiveness analyses do not include the effects of common parasitic diseases, such as schistosomiasis, on the effectiveness of ARTs.

My current work attempts to incorporate increasing returns (decreasing costs) that result from beneficial treatment spillovers (for example, deworming and ART efficacy) into a model of HIV and to include those spillovers in cost-effectiveness models. The obstacles are two-fold: the models used in AIDS policy and in health economics are generally linear and I need to know more math to fix them. I am working with a model borrowed from evolutionary biology, a Boolean network (in the invited article just submitted to *AIDS on Complexity*), but I am still looking for the right methodology.

I was a graduate student a very long time ago, and not even in math or epidemiology, but in economics. Nevertheless, the aims of the DIMACS institute match my work precisely. I am committed to continuing work on the epidemiology of HIV/AIDS and other diseases endemic in sub-Saharan Africa. I have a record of publication in the field. And I need further training to take the next step, translating the scientific evidence into a better specified model.

We have a new faculty member at Gettysburg College, Prof. Christina Hayes, a very bright and enthusiastic mathematician who is interested in modeling disease dynamics. I am an extra-departmental mentor for Christina, and I would like to be able to work on modeling with her.

We do not yet really speak the same language. I have the decades of experience in Africa and the biological and economic background. She has the math and some experience in disease modeling.

I will be in Botswana beginning June 1 working with a Botswanan assistant collecting data on cofactors and HIV. Once I get her started on her work, I am free to attend the institute beginning June 11. I would like to attend both weeks. If, however, you find that you have room in the first week, but you are crowded in the second week, I would still benefit greatly from attending the first week. My travel to and within Botswana and South Africa is covered by a Mellon grant, so I would not be taking resources from graduate students whom you could support for travel. If it is possible, I would appreciate help with local expenses during the institute, since the group will be staying together.