



N E R E N B E R G L E C T U R E

**Sex and HIV: When is it Better to be a Man?**

Sally Blower Gives the 2008 Nerenberg Lecture

By Christopher Essex

AIDS is arguably the scariest of sexually transmitted diseases. It is both personally terrifying, and the sheer number of cases has given it global significance.

Curiously, the last thing to come to the minds of many, when thinking about AIDS, or disease in general, is mathematics. But mathematics has been crucial in advances made in fighting AIDS, especially in leading the way to multi-drug therapies. Mathematical models have made it possible to understand the nature of AIDS in individuals and in populations. Through the effectiveness of the resulting strategies, mathematics has become responsible for saving many lives—a triumph for mathematical biology, and a stark reminder of the unparalleled importance of mathematics at a human level. Differential equations matter.

It is no surprise to an applied mathematics audience that nonlinear differential equations can, and do, turn intuition on its head as often as not. Nonetheless, specific examples are always fascinating—doubly so for those unaware of such things. It was in this way that Sally Blower upended audience intuitions at this year's Nerenberg Lecture on the dynamical modelling of HIV infection, with the challenging subtitle: “When is it better to be a man?”

Sally Blower is Director of the Biomedical Modeling Center, at the David Geffen School of Medicine, Semel Institute of Neuroscience and Human behavior University of California at Los Angeles. She is a biomathematician, expert in modeling the evo-



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lutionary dynamics of drug resistance, particularly drug resistant HIV and tuberculosis. She has published landmark studies in *Science*, *Nature Medicine*, the *Lancet* and *Proceedings of the National Academy of Sciences*. In addition to HIV, she has also worked on syphilis, genital herpes, smallpox, MRSA, tuberculosis, leprosy, trachoma, and influenza.

Professor Blower's Lecture began with a description of an emerging strategy to fight HIV through vaginal microbicides. Microbicides are currently considered the most promising biomedical intervention to prevent HIV infection in women. Clearly intuition suggests that wider application of such a treatment means less AIDS for women generally.

But complications arise because the microbicides can cause HIV-positive women to develop resistance. Blower showed by means of a dynamical model that a potential consequence of the planned trial designs was to mask resistance risks and therefore to enable high-risk microbicides to pass clinical testing. This leads to counterintuitive effects on the heterosexual population. In reducing an individual's risk of resistance during a trial, unexpectedly high rates of resistance may arise subsequently in public health interventions, potentially defeating the strategy. Moreover, her calculations show another surprise: such microbicides could prove of greater benefit to men, even though protecting women from infection was the first expectation.

Such paradoxes are important not only because they can guide clinicians on how to revise their trial designs, but they also remind us of the risk of the unintended consequences of naive interventions in complex systems—an important lesson for the audience to take away with them.

Organized by Western's Department of Applied Mathematics, the Nerenberg Lecture is named after the late professor Paddy Nerenberg and is intended to honour his appreciation for the democracy of ideas. He was Professor at Western for more than a quarter century, and a founding member of its Department of Applied Mathematics. The annual series is meant to challenge the public with ideas connected to mathematics that they may not see in any other forum.



Western's President Paul Davenport and Sally Blower