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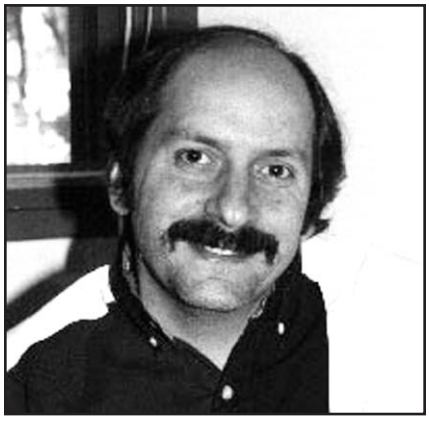
MBI Announces Year on Ecology and Evolution

The focus for 2005–2006 at the Math-ematical Biosciences Institute at Ohio State University is "Ecology and Evolution." "Historically, ecology and evolutionary biology have been two of the areas of biology that have most benefited from, and made use of, mathematical models," says Avner Friedman, the director of the MBI. "A long list of distinguished mathematical biologists have contributed to these areas, and their efforts have illuminated much of ecological and evolutionary theory over the past century."

One of the objectives of this year is to focus on specialized areas that offer particularly challenging mathematical problems, that are relatively unexplored, and that are of potentially great interest to observational biologists. Such areas, according to Lou Gross, one of the organizers of the year's program, include conservation biology, biodiversity, harvest planning, invasive-species control, and wildlife management. "These examples are just a few of the applications which utilize mathematical methods," Gross says, "and they rely greatly upon general ecological and evolutionary genetics theory."



Dennis Pearl, an associate director of the Mathematical Biosciences Institute, was an organizer of the tutorial amd workshop that opened the MBI program "Ecology and Evolution."

The year opened with a tutorial on tree reconstruction coalescence theory, followed immediately by a workshop on phylogeography and phylogenetics. A pattern of genetic diversity between and among species or populations can usually be explained and produced by different scenarios. According to Dennis Pearl, one of the organizers of the tutorial and the workshop, "maturation of phylogenetics methodologies will be critical if we hope to study such things as the tree of life, linking phenotype and historical evolution, viral evolution, and the evolution of regulation in protein expression."

Participants in a follow-up workshop will consider a related theme: self-organization in evolution. Chris Adami, one of the organizers, identifies the evolution of RNA viruses as one of the topics of concentration. "Most RNA viruses," he says, "live in rapidly changing worlds, because they constantly move from one host to another, and these hosts frequently differ in their properties." Topics to be discussed at the workshop include "how the time scale on which environments change influences the way in which viruses adapt to their present and future environments."

The winter program will begin with a workshop on spatial heterogeneity in biotic and abiotic environments. Whereas traditional theories have been concerned with local adaptation of genotypes, interest and emphasis have begun recently to shift toward biological questions concerning large-scale effects. For example, says Sergey Gavrilets, one of the organizers, "an important question is about the effects of immigration of locally deleterious genes on the degree of local adaptation, and the ability of species to expand their range."

Another workshop will focus on spatial ecology. According to organizers Claudia Neuhauser and Lou Gross, the workshop will deal with "some of the most critical questions that affect our ability to project the future trends of natural systems and, particularly, how human actions impact these systems."

Microbial ecology and global ecology are the themes of the spring program. Microbial biology is the study of how micro-organisms interact with each other and with the environment. "The struggle to understand these interactions," explains Frede Thingstad, one of the organizers of a workshop on microbial ecology, "stems from the fact that the relevant phenomena are occurring on spatial scales from that of a virus (10^{-8}m) to that of the ocean chlorophyll distribution (10^{6}m), and on time scales from milliseconds to a few billion years."

The workshop on global ecology will look at attributes of minimal mathematical models for global ecosystems. John Pastor, one of the organizers, identifies a few of the questions to be addressed: How rapidly and in what manner can global ecosystems change in response to changes in control parameters? How are inputs of relatively active gases, such as CO_2, altering global element cycles, global energy, and climate?

The mathematical methods used to address the various segments of the year's program clearly overlap quite a bit. Craig Moritz and Sergey Gavrilets are the co-organizers of a cross-cutting symposium that will bring together researchers from different disciplines to explore connections between phylogeny, phylogeography, and speciation theory. In addition, a special workshop scheduled for April 2006 will address uncertainty in ecological analysis. "The field of ecology," according to organizing committee chair Noel Cressie, "is becoming increasingly aware of the importance of accurately accounting for multiple sources of uncertainty when modeling ecological phenomena, analyzing data, and making forecasts."

"The year on evolution and ecology will bring together ecologists, evolutionary biologists, mathematicians, and statisticians," Friedman says; "we are looking forward to a series of very exciting and challenging problems where progress can only be made through interdisciplinary collaboration."

Additional information about the Mathematical Biosciences Institute can by found at http://mbi.osu.edu/.