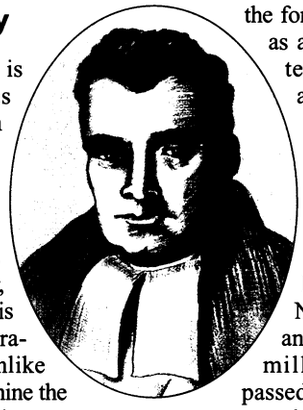
Some views about Bayesian statistical methods are offered, including that the methods seem to be "an attempt to find any port in a storm in the face of our belated realization of the overwhelming complexity of social and environmental systems." Strides toward intellectual and scientific exchange between U.S. neuroscientists and their Cuban colleagues are described. The scientists whose work on live oral polio vaccine was discussed in *The River* state that "no chimpanzee cells were ever used by us to make [oral polio vaccine]." A variety of comments about the situations tenured women face in academia are given. And the purposes of some ornamental structures on peacock mites are described.

The Bayesian Way



Thomas Bayes

Bayesian statistical analysis is hardly a new approach, as David Malakoff points out in his News Focus article "Bayes offers a 'new' way to make sense of numbers" (19 Nov., p. 1460). The method was developed by Thomas Bayes, a Presbyterian minister, in the mid-18th century and is characterized by its incorporation of prior knowledge (unlike frequentist methods) to determine the probability that a hypothesis is true. What seems to be occurring with the focus on Bayesian analysis is an attempt to find any port in a storm in the face of our belated realization of the overwhelming complexity of social and environmental systems. This attempt has led to the revivification of other operations' researchlike tools, for example, risk analysis. Frequentist statistical methods had become more like crude rituals, but let us not replace one over-rationalized crutch with another. The outcome of the New Jersey police application Malakoff describes ("The Reverend Bayes goes to court," p. 1462) is gratifying, but over-reliance on Bayesian methods in ecology, economics, and political science could bring catastrophe. What is needed is a better education of both scientists and policy-makers in the nonlinearity, feedback loops, and far-from-equilibrium nature of complex systems—this, and a bit more humility as to the limits to our capability of knowing and controlling the world around us.

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In his article about Bayesian statistics, Malakoff does not mention what is to me the most important difference between Bayesian methods and "frequentism"—with the former, probability is not treated as an intrinsic property of a system; rather, it is a statement about an observer's state of knowledge of the system.

For a long time I'd struggled with nagging discomforts with frequentist approaches, especially in dealing with low-probability, high-consequence events. Nuclear safety was the focus, and I sensed that however many millions of reactor-years had passed without a big accident was somehow missing the point.

Years ago I took a course taught by Ron Howard of Stanford University, one of the prime movers behind decision theory. At one point in the class, he flipped a coin and held it covered in his hand. He asked the class to estimate the probability of "heads," and of course we confidently replied 50%. Then he peeked, paused a moment, and asked us again. For him, the probability had changed, to either 0 or 100%, but for the rest of us, it was still 50%—as the best information we had available to us.

He went on to mention that there are people who can flip a coin and always get heads (Persi Diaconis, for one, a mathematics professor at Harvard University and self-taught magician). To belabor the point, the laws of motion will determine the result, given initial conditions, so 50% is by no means an intrinsic property of flipped coins.

Somewhere, there is a particular component or system (or person) at a particular reactor that will cause the next serious reactor accident. The probability is 100%. Unfortunately, we don't have the means to know which reactor will fail, so we are stuck with estimates based on the number of reactor-years, the mean time between failures, and various other factors.

Frequentist approaches can help improve an observer's state of knowledge, but they do not measure intrinsic properties of things. Theories are often superseded by more general theories, but are still useful within certain bounds. Frequentism is a special case of Bayesian statistics where there is no prior knowledge.

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U.S. and Cuban Scientific Exchange

From 20 to 23 October I was among a group of 21 U.S. neuroscientists who met with 30 of their Cuban colleagues in Havana in the first bilateral meeting on the life sciences since the imposition of the U.S. trade embargo 37 years ago. Our objective was to build bridges between Cuban and U.S. neuroscientists. It was the result of nearly 3 years of planning on the part of Peter Valdes, acting director of the Cuban Neuroscience Center, and myself (*1*).

It was clear from the meeting that the embargo has hindered the progress of scientists in Cuba and has shortchanged U.S. scientists by preventing our interaction with them. Just after the meeting, most of the U.S. scientists attended the Society for Neuroscience meeting in Miami, Florida. The society has invited a handful of Cuban colleagues over the past few years, but only two have been able to get into the United States, and both received visas only at the last minute. The possibility to develop joint projects (in a variety of fields in addition to neuroscience) has been stymied by these policies. But our meeting in October was an opportunity for scientists to speak freely and to establish professional relationships. It also resulted in the creation of a binational committee to promote exchange of information and material for neuroscience, as well as an exchange program for basic and clinical neurosceintists.

Cuban scientists and clinicians have made great strides in research, drug delivery, and health care delivery. They have led the world in the development of low-cost brain-imaging technology. The availability of these instruments would enhance rural medicine in the United States, where sophisticated, high-quality medical imaging may be far away. And in 1986, Cuban scientists developed and distributed a vaccine to combat meningitis, which was supplied worldwide, but was not available in the United States until this year because of the trade embargo. Three thousand U.S. children are affected by meningitis B each year.

The stated intent of the embargo has been to bring about the political demise of Fidel Castro. The actual effect has been to cause needless suffering, including widespread shortages of food and medicine,

and to thwart development in Cuba. As a scientist, I would never continue the same failed experiment for 38 years. It is time for our government to change its experimental strategy as well.

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References and Notes

1. The meeting was organized as a continuing medical education course at the University of Illinois, Chicago, through the efforts of Moises Gaviria and was sponsored by several pharmaceutical companies (Jannsen, AstraZeneca, Wyeth-Ayerst, and Solvay), as well as the John D. and Catherine T. MacArthur foundation of Chicago.

Responding to *The River*

In the book *The River: A Journey to the Source of HIV and AIDS* (Little, Brown, 1999), author Edward Hooper suggests that we covertly used chimpanzee cells to produce the live oral polio vaccine (OPV) that was used in the first mass campaign with OPV in the former Belgian Congo. Hooper postulated that the cells contained a simian immunodeficiency virus that later mutated to human immunodeficiency virus.

In his review of *The River* (*Science*'s Compass, 12 Nov., p. 1305), Robin Weiss expresses skepticism about the book's basic hypothesis. His skepticism is well founded, because no chimpanzee cells were ever used by us to make OPV. Data bearing on this point are being collected and will be published in a scientific journal. It is thus ironic that the year 2000 will be the 50th anniversary of the first trials in humans of an OPV (*1*), and also the year in which polio will perhaps be eradicated, thanks to the use of mass campaigns of vaccination such as the ones performed in the then Belgian Congo (*2*, *3*) and in the then Soviet Union (*4*).

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Tenured Women in Academia

In Andrew Lawler's News Focus article "Tenured women battle to make it less lonely at the top" (12 Nov., p. 1272), the information in the graph of the faculty mix at Harvard University and the Massachusetts Institute of Technology (MIT) (p. 1273) appears to undermine his thesis that senior women scientists are being hired and promoted at these institutions in disproportionately low numbers. The graph indicates that faculty size has been essentially flat at both institutions since 1979. At MIT the decline in male faculty since 1979 appears to be balanced by growth in female faculty. If the decline in male faculty represents most of the positions that became available between 1979 and 1999, then MIT has been hiring mainly women to fill vacancies left mainly by men. At the very least, women have been hired to a greater degree than their proportion in the applicant pool. How can MIT do much more to increase the number of faculty women? The main problem is one of not enough available jobs, and this means, of course, that there are many highly qualified men who will never find satisfactory employment of any form in