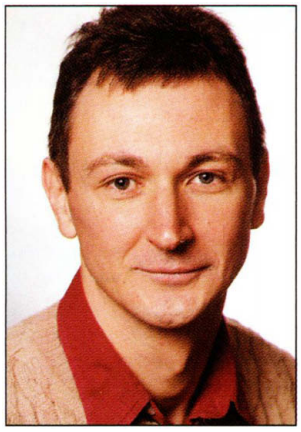
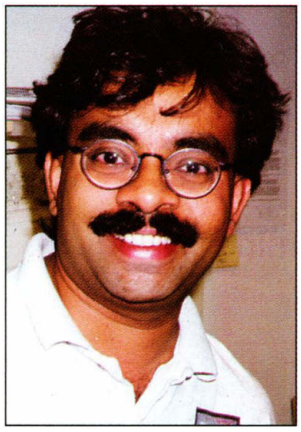
under very specific conditions. "A very strange thing about the Langlands Program is that it is so beautiful, that it is so seductive, that what it sets forth is so simple, and that it puts together so many different phenomena," says Lafforgue. "Since the formulation by Langlands, everybody is absolutely convinced that the set of conjectures is true."





Honored. Fields medalists Voevodsky (*left*) and Lafforgue took laurels for finding hidden connections in mathematics; Nevanlinna winner Sudan (*right*), for wedding probability to proof.

In 1999, Lafforgue won mathematical acclaim by proving the Langlands Conjecture for a very broad class of objects known as function fields (*Science*, 4 February 2000, p. 792). "I knew that it was an important result. For the following 2 years, many mathematicians around me thought that it would receive the Fields, but I preferred not to think about that," says Lafforgue. "Today, of course, I feel deeply honored and happy to obtain so much recognition for my work."

The other new Fields medalist, 36-year-old Vladimir Voevodsky, toiled at the intersection of two other mathematical subjects: topology, which studies shapes in space, and algebra, which studies the symmetries and relations of abstract mathematical operations. Mathematicians have had remarkable success in trying to teach the two fields to speak the same language, but some areas still can't communicate, even though they seem to have similar structures. In 1970, mathematician John Milnor of the State University of New York, Stony Brook, conjectured that two such uncommunicative realms—ways of describing properties of different kinds of surfaces known as Galois cohomology and K-theory—were in fact related. The Milnor Conjecture remained the biggest problem in that area of mathematics until 1996, when Voevodsky created new mathematical tools that enabled him to solve the conjecture.

The Rolf Nevanlinna Prize honors MIT's Madhu Sudan, age 35, for his work on the very concept of mathematical proof. A proof is a series of logical statements, each linked to the next according to strict rules of inference. If the statements are correct and the links obey the rules, the proof is valid; otherwise it is flawed.

Sudan added shades of gray to this black-and-white dichotomy by showing that, in theory, a mathematician could figure out the probability that a new proof is correct. He knew that, in a sense, valid proofs are points floating in an abstract space that describes all logical statements. "Distance" makes sense in the abstract space of logical statements, just as it does in familiar geometric space.

Sudan was among the first to realize that the concept of logical distance could be used to measure how far from truth a putative proof might be. "You can show whether any proof is completely correct, [whether it] can be formulated into one that is completely correct, or whether it is so distant from correctness that it is unfixable," Sudan says. And although the idea isn't going to lead to automatic proof-checkers, it has helped Sudan make inroads against the most important question in computer science, the P = NP problem (*Science*, 26 May 2000, p. 1328).

–CHARLES SEIFE

CREDITS: (LEFT TO RIGHT) CLIFF MOORE; MIT LABORATORY FOR COMPUTER SCIENCE; NOAA

EVOLUTIONARY BIOLOGY

Cool Cats Lose Out In the Mane Event

The image of a roaring male African lion with full flowing mane is for many people the very icon of wild nature. But precisely why lions have manes has never been nailed down. On page 1339, researchers provide evidence for the often-cited assumption that the mane is a signal advertising the animal's condition, which females use to choose mates and males use to assess rivals.

In an apparent evolutionary tradeoff, however, manes also impose a cost on males by increasing their heat load. "This is one of the few cases of a sexually selected trait where a physiological cost has been demonstrated," says evolutionary biologist John Endler of the University of California, Santa Barbara.

Animal behaviorist Craig Packer of the University of Minnesota, Twin Cities, has studied lions at Serengeti National Park in Tanzania for 24 years, continuing the program that pioneering zoologist George Schaller began in the 1960s. Over the years,

ScienceScope

Rights Reconsidered The National Institutes of Health (NIH) has put on hold a controversial plan to curb foreign grantees from patenting and licensing their discoveries. Last March, NIH announced that it would limit foreign grantees to patenting discoveries only in their home nations. To make sure U.S. taxpayers reaped the benefits of federally funded research, all other rights would be held by U.S. collaborators or NIH. But critics—including the U.S.-based Association of University Technology Managers and Australian science officials—said the policy would hinder collaboration and discourage the development of discoveries (*Science*, 28 June, p. 2316).

On 8 August, NIH backed off, saying that it will take another year to "explore more fully the ramifications" of the policy, which was slated to take effect at the end of the year. "There's no point in rushing," says NIH extramural research chief Wendy Baldwin. Her office will consider arguments that, for example, most drugs end up being manufactured in the United States, so the profits end up there, too.

New Hire A top government science chief has agreed to oversee science programs at the beleaguered Smithsonian Institution, which has been shaken by the departures of senior administrators and controversial reorganization plans (*Science*, 13 July 2001, p. 194). Physical oceanographer David Evans (right), currently assistant administrator for research at the National Oceanic and Atmospheric Administration (NOAA), will become the Smithsonian's undersecretary for science on 9 September. He replaces Dennis O'Connor, who resigned in April. Evans, 56, has been at NOAA since 1993 and helped organize the government's climate research program. He also spent 5 years as a program manager at the Office of Naval Research.

Evans told *Science* that his experience will help him tackle the task of stabilizing the Smithsonian's science programs, including boosting budgets squeezed by construction and renovation expenses. "I've dealt with a lot of fiscal crises," he says, and he is "optimistic" that he can convince Congress or private donors to improve cash flows. He also needs to hire a new head of the natural history museum and hopes to smooth out currently rocky relations between some administrators and researchers. His past work, he says, "has taught me that you lead scientists, you don't push them around."

his group has built up a huge database on individual animals.

When Peyton West arrived as a graduate student to work with Packer, she used this information to ask why lions have manes. Are they akin to a peacock's tail: a useless ornament favored by sexual selection? Or does the mane protect the neck and head during fights, another frequent speculation? "There's been this archaic notion of protection and also this inchoate sense that it's probably sexual selection," says Packer.

West and Packer matched photographs of individual lions to records of their age and condition since 1964. Lions with longer and darker manes, they found, were more mature, had higher testosterone levels, lacked injuries, and were better nourished.

Hello, handsome. Female lions prefer males with dark manes, but such decoration comes at a cost.

To determine experimentally whether manes advertised health and status, West and Packer set out life-sized models of male lions with manes of different colors and lengths and observed nearby lions' behavior. Males avoided models with dark, long manes, preferring the company of light- and short-maned cats—apparently to sidestep conflict with macho alpha males, the researchers reason. In a second experiment, West and Packer broadcast female lion calls and found that dark-maned males led the way toward the new females. Evidently, dark manes tell other males to back off.

Females reacted to the experimental models differently. They sidled up to the dark-maned males, confirming a preference detected in observational data. The females' preference makes sense, the researchers point out, if dark manes reflect maturity and good physical condition. A male in top condition can better defend its females and cubs from attack by other teams of males.

But great manes come at a cost: Imagine wrapping a long woolen scarf around your neck on a hot summer day—or, more accurately, five or six scarves. Using an infrared camera, the researchers could plainly see that manes, especially long and dark ones, were a major source of heat, a liability on the hot African savanna. Indeed, the long-term data revealed that manes grew shorter and lighter colored with warmer seasonal temperatures. This pattern holds across large geographic regions, too; lion subspecies in cooler climes such as Morocco and South Africa's Cape region have extensive manes, whereas many in Kenya's scorching-hot Tsavo National Park lack manes altogether. All this suggests that manes impose a significant physiological cost on the animal.

Thus, say the researchers, any male that can put up with this cost and still look good must be a real stud. Sexual selection theory would term the mane an honest indicator of good quality.

Behavioral ecologist Göran Spong of Uppsala University in Sweden, for one, is not convinced, asserting that the study still doesn't resolve whether the mane is a "badge" for signaling or a "shield" for protection in fights. While granting that the work is "impressive," Spong says that no single line of evidence is conclusive: "Whether [to] believe the weighed sum of all their arguments, I think, is more a matter of taste than objective deduction."

But Endler praises the study, particularly for its attention to the costs of temperature. "Most studies only speculate about costs or regard predation risk as a cost," he notes. "So now we have predation, locomotion, and thermoregulatory costs as known factors balancing advantage to sexually selected traits. It's getting more interesting each time a new factor is explored." **–JAY WITHGOTT**

Jay Withgott is a science writer based in San Francisco.

CENTRAL EUROPE FLOODS

Labs Spared as Climate Change Gets Top Billing

BERLIN—The record-breaking floods that overwhelmed villages and centuries-old historical monuments in central Europe last week spared most science institutes in the region. They also raised the profile of climate change researchers, who were bombarded with questions about whether the floods were proof of global warming.

A decision by the newly opened Max Planck Institute of Molecular Cell Biology and Genetics in Dresden to seal its foundation "like a watertight bathtub" kept the low-lying institute dry and fully operational throughout the catastrophe, says director Kai Simons. "We're fine," Simons says, despite the fact that the Elbe River topped by half a meter its previous record height in 1845. Its riverside neighbor, the university clinics at Technical University Dresden, wasn't so lucky, evacuating patients through waterlogged streets. Upstream in Prague, the city's main science institutes and museums also escaped severe damage.

Television images of historic palaces under water and homes washed off their foundations triggered new interest in climatology throughout Germany. The events, coming just a month before national elections, also gave politicians an opportunity to debate the merits of environmental taxes and research on renewable energy sources. "Until now, many people thought that global climate change was happening elsewhere and would not affect our weather patterns here in Europe. This has now dramatically changed," says climate researcher Mojib Latif, spokesperson for the Max Planck Institute for Meteorology in Hamburg.

Latif, who fielded 30 calls a day for several days, has argued that extreme weather events will become more common as human-triggered carbon dioxide levels rise and global temperatures increase. Christian Schönwiese of the University of Frankfurt am Main, who also fielded dozens of press calls, is more cautious. The unusual weather behind this flood is not necessarily linked to human-made increases in carbon dioxide levels, he explained. However, he told the *Berliner Zeitung* that "I can put up with a few misinterpretations" of the details if the floods leave behind greater public awareness about the potential dangers of global warming.

–GRETCHEN VOGEL

Information flow. Floods in Dresden and elsewhere triggered a fresh debate over global warming.

CREDITS: (TOP TO BOTTOM) P. WEST *ET AL.*; CHRISTOF STACHE/AP