Smithsonian Institution

Spotlight on Science at the Smithsonian

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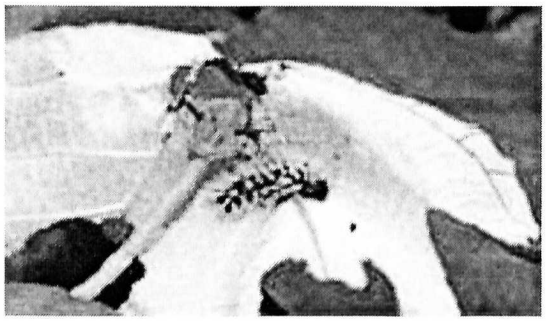


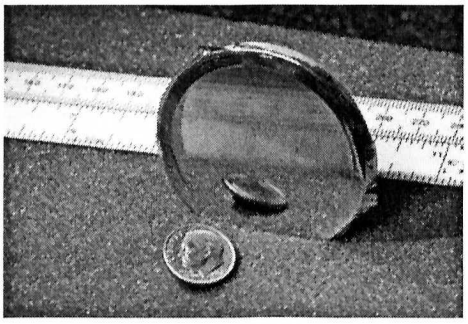
A *Colobura dirce* caterpiller feeding on the underside of a *Cecropia* leaf in the forest canopy in Panama.

Doing What Comes Naturally

STRI research fellow Sunshine Van Bael, former STRI fellow Jeffrey Brawn, and Scott Robinson, all from the University of Illinois at Urbana, have discovered that birds in Panamanian forests protect trees by feeding on leaf-eating insects. Van Bael conducted research using STRI's canopy crane access system, which allowed for repeated observations of branches where foliage was accessible and inaccessible to birds. Where the birds has access to foliage, the trees remained healthy and lush due to the consumption of herbivores.

The National Zoo's Migratory Bird Center has provided funding for Van Bael to evaluate plantations of cacao plants as potential habitats for migratory birds, which have been losing their habitats to deforestation in Panama. She has found that although herbivore activity itself isn't a significant problem for cacao production, fungal disease, often carried by arthropods (e.g., insects and crustaceans), is its biggest challenge. By possibly attracting more migratory birds, cacao plantations could reduce disease and increase productivity.

These findings, which will be published this week in the early online edition of the *Proceedings of the National Academy of Sciences,* give strength to the argument that natural controls of insect and arthropod populations are always better and cheaper. The study also provides scientists with baseline knowedge that may prove useful for forest management as changes in climate alter the interactions between plants and animals.



One of the new infrared filters, hand-mounted on a metal support ring. Optical light is partially transmitted by the thin film; infrared wavelengths are blocked, except over a narrow range.

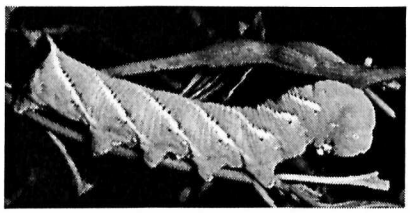
Designer Filters for Astronomy

Astronomers advance the frontiers of knowledge about our universe – and sometimes even beyond our universe. Because astronomers do not have the luxury of reproducing most cosmic conditions in their laboratories, they are forced to gather information from distant objects using the most sensitive techniques and sophisticated instruments they can invent. As a result, astronomers often find themselves pioneering new technologies that sometimes find other applications in the research, medical, or commercial worlds.

In last week's *Applied Physics Letters*, Smithsonian Astrophysical Observatory astronomer Howard Smith and his colleagues described a new method of fabricating infrared filters: thin sheets of material that permit only carefully selected wavelengths of infrared light to pass through them. Conventional infrared filters, like the optical filters on a camera lens or sunglasses, have special coatings to limit the light that is transmitted. In the new design, nanotechnology is used to deposit layers of plastic with a precise pattern of tiny metal lines whose characteristic dimensions are less than about one-tenth the width of a human hair. The metal lines act like finely tuned screens to filter the radiation.

The new method is a major advance over the conventional coating process because the new filters have sharper wavelength discrimination features, are much more rugged, and are cheaper to manufacture. They can also be used at wavelengths where coatings do not work at all. The scientists also developed a computer code to design and model these new filters.

The team developed the new technology to be able to search for hard-to-see radiation from atoms and molecules in space. They are in the process of patenting the new technology, and plan to use the improved filters in upcoming National Aeronautics and Space Administration missions to study the birth of galaxies, stars and planets. Meanwhile the technique, which can be used to make filters for a wide range of other applications, will be featured in the June, 2003, issue of the trade journal, Laser Focus World.

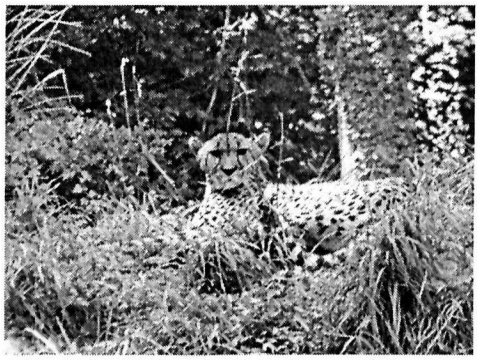


***Manduca sexta* of the family *Sphingidae* (hawkmoths)**

Calling All Caterpillars!

On June 19–28, museum staffers Karie Darrow, Marc Epstein, and John Burns of National Museum of Natural History (NMNH), and Yves Basset and Annette Aiello of the Smithsonian Tropical Research Institute (STRI), participated in a National Science Foundation (NSF)- and Area de Conservación Guanacaste (ACG)-sponsored workshop on the biology and biodiversity inventory of caterpillars in northwestern Costa Rica. Convened by Daniel H. Janzen of University of Pennsylvania, the workshop brought together many of the world's caterpillar biologists to enable them to update each other on their respective projects, shared goals, and problems.

The ACG is a conserved "wildland" in northwestern Costa Rica, comprised of 120,000 terrestrial and 43,000 marine hectares. The workshop contributed to the long-term ACG goal of inventorying the entire caterpillar fauna, which calls for identifying over 7,000 species of macrocaterpillars, their food plants, and their parasites, and transferring that information to the Internet (http://janzen.sas.upenn.edu). Workshop participants got a first-hand view of the mechanics of the ongoing NSF- and ACG-supported inventory and ACG's three major caterpillar-rich ecosystems—dry forest, cloud forest, and rain forest.



Cheetah resting in the shade at the zoo.

Will Zoo Cat Need a Cradle?

National Zoo researchers have been studying cheetah reproductive physiology for two decades. Through DNA analysis, they have determined that cheetahs went through a genetic bottleneck thousands of years ago (probably not human induced), which has resulted in a number of genetic maladies that make them difficult to breed. To address this problem, National Zoo reproductive physiologists have developed and successfully used state-of-the-art artificial insemination techniques in various facilities in North America.

Now, Mother Nature has come to assist the Zoo in its cheetah breeding efforts. On June 2 and 3, 2003, at the Zoo's Cheetah Conservation Station, Wandu, an 11-year-old female, mated naturally with Norok, an 11-1/2-year-old male. Zoo researchers won't know if Wandu is actually pregnant until mid- to late August—about the time she would be expected to give birth.

Cheetahs frequently go through a "false pregnancy," in which they appear to be pregnant after copulating, but are not. So, while zookeepers are elated by this most recent mating, it is still too early to get excited. In the interim, Zoo scientists and keepers will manage Wandu as though she were pregnant until a cub is born or a hormonal analysis indicates the end of a false pregnancy.

Ancient Corncobs Show Their True Genes

Last week, archaeology curator Bruce D. Smith and Viviane Jaenicke of the Max Planck Institute in Leipzig, Germany, traveled to Chicago's Field Museum, as part of an ongoing genetic study of ancient corn in the U.S. Southwest. Their objective was to expand their collection of corncobs from Tularosa Cave, near Aragon, New Mexico. Excavated in 1952, Tularosa Cave yielded more than 33,000 ancient maize cobs, which are now under the Field Museum's curatorship.

The initial analysis of a small number of maize cobs from different layers in the cave, carried out by collaborating geneticists from Germany, Wisconsin, and North Carolina, has shown that significant genetic change took place in the corn being grown in the Southwest somewhere between 1,000 and 2,000 years ago. Smith and Jaenicke selected an additional 100 maize cobs for more detailed analysis, now being conducted at the Max Planck Institute.

Recent Publications

Engelbrecht, B.; Kursar, T. 2003. "Comparative grought-resistance of seedlings of 28 species of co-occurring tropical woody plants." *Oecologia* Online.

Kitajima, K.; Hogan, K. 2003. "Increases of chlorophyll a/b ratios during acclimation of tropical woody seedlings to nitrogin limitation and high light." *Plant, Cell and Environment* 26(6): 857-865.

Shoemaker, D.; Keller, G.; Ross, K. 2003. "Effects of Wolbachia on mtDNA variation in two fire ant species." *Molecular Ecology* 12(7): 1757-1771.

Smith, H.; Sternberg, O. 2003. "Designer infrared filters using staked metal lattices." *Applied Physics Letters* 82, 3605.

Web Links

Sunshine Van Beal's complete article regarding the interaction between plants and animals can be seen at www.news.uiuc.eduscitips/03/0623panama.html.

Learn about more that 7000 species of caterpillars at http://janzen.sas.upenn.edu.

Spotlight on Science at the Smithsonian

Spotlight on Science at the Smithsonian is a weekly electronic newsletter about Science at the Smithsonian. It is produced for the Smithsonian community by the Office of the Under Secretary for Science. To contact the editor, e-mail mellendickt@si.edu.

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