Smithsonian Institution

Spotlight on Science at the Smithsonian

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Leaf-cutter cutting *Ochroma* leaves

Exploring the Mysteries of Underground Gardens

In a world full of deadly microbial pathogens and parasites, it is often easy to overlook the beneficial relationships ("symbioses") that many fungi and bacteria have with their hosts. The interaction between attine ants and their cultivated fungi forms one of the most fascinating symbioses in nature.

The ants cut live leaf material and carry it down to their massive underground fungus gardens. The fungi digest the plant material and convert it to a form palatable to the ants. The symbiotic combination of ants and their fungi is very effective, and together they comprise perhaps the most devastating agricultural scourge to be found in the New World tropics.

An overview of work conducted by Cameron Currie, as a Smithsonian Tropical Research Institute (STRI) pre-doctoral fellow, was recently published in *Science* magazine and highlighted in the *New York Times* Science section. Currie and his collaborators have unveiled two additional crucial players in a game that has been ongoing for over 50 million years. The first new player is another parasitic fungus that can infect the ants' gardens, forcing them to abandon their nests or perish. The second is a type of chemical-releasing bacteria that the ants produce to inhibit the growth of the parasitic fungus.

Although the attine ant-fungus symbiosis is one of the best understood and most complex cases known, surprises turn out to be the rule, not the exception. Work by STRI postdoctoral fellow Seirian Sumner has shown that there is a parasitic *ant* to be contended with, as well. Currie sums it up nicely when he says, "Every step along the way, there are more questions and new directions."

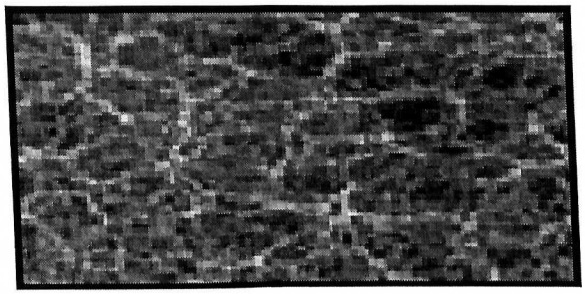
NMNH etomologist Terry Erwin samples canopy insects

A Who's Who of Tropical Bugs

Tropical forest canopies house some of the most diverse yet least understood creatures on our planet. Canopy biologists--the pioneers of a very young science--are just beginning to describe this complex interface of plant and animal life.

The recently released *Arthropods of Tropical Forests* is a major contribution to state-of-the-art tropical entomology research. Edited by Yves Basset (Smithsonian Tropical Research Institute), and Scott Miller (National Museum of Natural History) this 490-page volume is a who's who of tropical entomology. Contributions from 79 co-authors examine the distribution, resource use, and life histories of insects and spiders living in tropical canopies. In particular, most of canopy research was performed in Panama under the umbrella of STRI's Forest Can-

opy Biology Program, which operates two canopy cranes. While the authors present data from Australia, Asia, and Africa, the bulk of the data is from research conducted at STRI in Panama or by Natural History Museum staff and their colleagues.



Theoretical model of the distribution of material in the early universe.

First Galaxies Light Up the Universe

How long did it take for the first stars and galaxies to form, once the universe was created in the Big Bang? Did they look anything like the stars and galaxies we see today, fourteen billion years later? The Center for Astrophysics' astronomer and his colleague have concluded that it only took close to a billion years to make galaxies the size of our Milky Way. This is a remarkably short time--much faster, for example, than the billions of years we speculate that it took for primitive life on Earth to evolve onto land.

The scientists examined and modeled recent data on extremely distant quasars--very bright galaxies whose radiation, we surmise, is dominated by giant black holes at their centers. The light from one of the quasars they studied left its mysterious source when the universe was very young, only about 900 million years old. The scientists' conclusions therefore imply that this glaxy, which they estimate to be roughly about as massive as our Milky Way, formed in what is a remarkably short time (much faster, for example, than the billions of years we speculate that it took for primitive life on Earth to evolve on land). Their modeling also suggests that every year the massive black holes at the centers of these galaxies attract several thousand solar masses of material from the surrounding space into the galaxies.

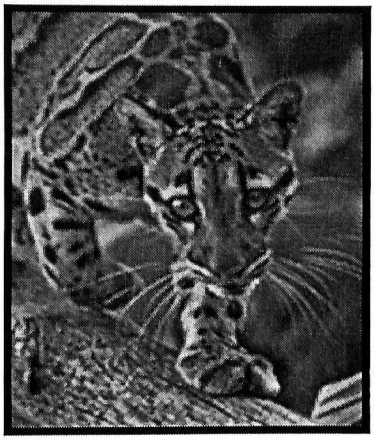
Late Classic Maya polychrome cylinder, ca. 650-750AD, chemically determined to have been made at Tikal (Guatemala)

"Fingerprinting" Bearers of Human History

The pictures and hieroglyphics on Classic Maya ceramics provide incomparable details about courtly life, politics, and religion during the period A.D. 250-900. Used to serve food during feasts and as royal gifts for important social and political events, these vessels communicate information that may not be recorded on stone monuments or where on the archaeological record.

Smithsonian Center for Materials Research and Education's Maya Ceramics Project has made great strides in identifying the origins of these ceramics, whose provenance was previously unknown. The project analyzes the vessels' ceramic pastes through neutron activation and uses the resulting chemical data as a means of "fingerprinting" the pottery. Then by comparing their imagery and compositional fingerprints with pottery from known locations, archaeologists can specify geographic regions, sites, and even specific workshops and master ceramists.

Featured in the next issue of *Archaeology* magazine, the project has assembled an extensive database of vessels from collections throughout the world. The article's international distribution will introduce new audiences to how science can link objects scattered around the world into a common database that enhances the understanding of these extraordinary bearers of human history.



Scientists at the National Zoo are studying the endangered clouded leopard in Thailand.

Felines and Leopards and Elephants, Oh My!

The National Zoological Park's JoGayle Howard, Katey Pelican, and from the Cincinnati Zoo Bill Swanson shared an excellent adventure in Thailand. Their feats included:

- conducting a feline reproduction workshop at Kasetsart University;
- demonstrating improvements in the health, behavior, and breeding of clouded leopards at Khao Kheow Open Zoo, as a direct result of improved diets, husbandry, and housing;
- working with the Zoological Park Organization on developing a Genetic Management Plan for fishing cats in Thailand and Southeast Asia;
- training staff at the Royal Forestry Department, Khao Yai National Park, and WildAid in monitoring and assessing wild elephants and felines in Khao Yai and;
- imported 4 crates of clouded leopard, fishing cat, marbled cat and golden cat fecal samples for hormone analyses at National Zoo's Conservation Research Center.

Recent Publications

Rappole, John. Bird of the Mid-Atlantic. University Press , 2003.

Basset, Yves; Kitching, Roger; Miller, Scott; Novotny, Vojtech. Arthopods of Tropical Forests. Cambridge University Press, 2003.

"Spectral signature of cosmological infall of gas around the first quasars," *Nature* 2003 January 23.

"Feeding the first quasars," *Nature* (News and Views) 2003 January 23.

"Up, up and away," *Nature* (News Feature) 2003 January 23.

"Late-Pliocene Homoand Hominid Land Use from Western Olduvai Gorge, Tanzania ," *Science* 2003 January 21.

"Ancient Tripartite Coevolution in the Attine Ant-Microbe Symbiosis," *Science* 2003 January 17.

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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