Biology

From Atlanta at the annual meeting of the American Society for Microbiology

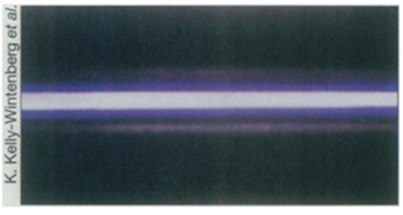
Plasmas put the hurt on microbes

Plasma, a gaslike state of matter composed primarily of electrically charged particles, usually turns up as a topic of conversation among physicists or *Star Trek* fans. Now, microbiologists are taking an interest in this relatively obscure state of matter. They're testing whether plasmas offer a novel way to sterilize surfaces, or even food.

Various sterilization methods—heat, radiation, and chemicals, for example—are employed commercially to eliminate dangerous or troublesome microorganisms. Yet each has its limitations. Heat sterilization can take a long time, and irradiation may damage a material. Consequently, researchers are always on the lookout for new and improved sterilization methods.

Scientists at the University of Tennessee in Knoxville may have invented just such a method when they recently developed the technology to create a plasma from air at room temperature and normal atmospheric pressure. Generated between two metal electrodes, the plasma can kill bacteria on various solid surfaces in seconds to minutes, Kimberly Kelly-Wintenberg and her colleagues have found. "We've just begun to test foods," she says. The patented technology may one day sterilize dry food items such as sugar, coffee, spices, and teas, she adds. Liquids quench the plasma.

In addition to destroying bacteria, the plasmas also eliminate bacterial spores, fungi, and viruses, according to the researchers. The killing mechanism is still under study. Plasmas contain several types of particles, including charged particles and neutral particles such as oxygen in its single-atom form, that could account for its ability to sterilize. The U.S. military has already provided money to examine whether the plasma technology can decontaminate equipment exposed to biological warfare agents, notes Kelly-Wintenberg. —*J.T.*



Plasmas (thin, glowing purple lines) may help sterilize materials and food.

Foxy fungi tarnish old books

Rust-colored splotches often mar the pages of books from the 19th century and earlier. In the late 1970s, electron microscope pictures of these splotches revealed the presence of fungi. The coloring phenomenon, called foxing, apparently stems from metabolic by-products of such paper-digesting organisms.

Now, polymerase chain reaction (PCR) analysis has helped identify some of the fungi causing these reddish blots. Raymond F. Sullivan of Rutgers University in New Brunswick, N.J., and his colleagues used PCR to look for fungal DNA in 10 books, each more than a century old and spoiled by foxing. In a few foxed areas, but not in unmarked pages of the same books, the researchers detected DNA fragments that they identified as belonging to members of the fungal genus *Aspergillus*. —*J.T.*

Bacterial gene makes the sun fun again

Microorganisms don't have money to purchase sunscreen lotion, so they've had to develop other means of dealing with the danger posed by DNA-damaging ultraviolet radiation. Take *Pseudomonas syringae*, a bacterium that infects the surfaces of plant leaves. UV rays bathe the home of this microbe, but it somehow tolerates the exposure.

George W. Sundin of Texas A&M University in College Station has now found that many strains of the bacterium have an extra loop of DNA, called a plasmid, containing a gene that encodes a protein which seems to be involved in DNA repair. This plasmid increases 5- to 50-fold the strains' tolerance of UV light. Moreover, if Sundin adds copies of this gene to a *P. syringae* strain with a missing or mutated copy, the engineered bacteria develop significantly greater UV tolerance than they had previously. Sundin speculates that researchers trying to use harmless bacteria to foil various plant pathogens could give such biocontrol agents an advantage by endowing them with this UV-protective gene. —*J.T.*

Sheep bacteria widen diet of cattle

If sheep had a sadistic sense of humor, they might chortle over their ability to consume large amounts of weeds such as tansy ragwort, while cattle, their lumbering companions in the pasture, invariably suffer fatal liver damage if they devour too much of the plants. The sheep's advantage stems from bacterial helpers residing in its rumen, the first stop in its multi-chambered stomach. The microbes help the sheep quickly detoxify the poisonous alkaloid compounds in tansy ragwort and many other plants. Cattle don't normally harbor the quick-acting bacteria; consequently, cattle ranchers suffer many millions of dollars in lost livestock every year.

A solution may lie in endowing cattle with the protective sheep bacteria, suggests Wade H. Johnston of Oregon State University in Corvallis. He and his colleagues had shown that transferring the contents of a sheep's rumen to a cow enables the cow to consume feed with tansy ragwort in it. They have now established a culture of the bacteria found in sheep rumen and shown that inoculating the rumens of cattle with the microbes offers a similar protective effect. "A microbial supplement for prevention of tansy toxicosis is commercially possible and technically feasible," says Johnston.

"We're very interested and keen on this approach to toxic plants," comments Mark Rasmussen of the National Animal Disease Center in Ames, Iowa. He notes that a decade ago, a colleague of his developed a similar solution to Leucaena, another toxic plant. In that case, bacteria from Hawaiian goats were found to protect cattle. "The big challenge is to find the appropriate bacteria and make them amenable to inoculation in cattle," says Rasmussen. —*J.T.*

Tansy ragwort, a weed toxic to cattle.

Ahh, the sweet smell of bacteria

When farmers store waste from their livestock in artificial lagoons, the stench can be overwhelming. Bacteria feed on the waste and produce hydrogen sulfide, ammonia, and volatile organic compounds. Yet as the summer heat rolls in, farmers report that waste lagoons sometimes turn a deep purple and reek less.

The welcome change stems from photosynthetic bacteria that bloom in the waste. After examining samples from several waste lagoons, Young S. Do of Iowa State University in Ames and his colleagues isolated one of the odor-reducing bacteria and identified it as *Rhodobacter spheroides*. In laboratory experiments, this microbe degraded many different odorants, including volatile fatty acids and various phenol compounds. Do suggests that seeding such bacteria into waste lagoons might make life on the farm a much less malodorous experience. —*J.T.*