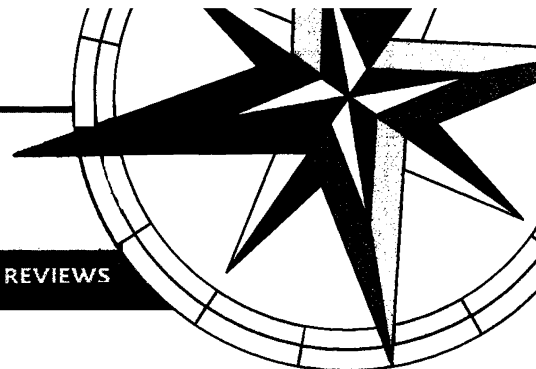




Chips, Infections, and National Security

THE RECENT OUTBREAKS OF ANTHRAX IN THE United States have brought a new urgency to the diagnosis of infectious disease resulting from bioterrorism. At the early stage of infection, pulmonary anthrax mimics viral upper respiratory infections; it is only later in the disease, often when the pathology of the disease has become life-threatening, that the bacteria can be directly detected.

In the 26 October issue of *Science*, a report appeared indicating that a bacterium, a virus, and a fungus induced unique patterns of gene expression in immune cells in vitro that could be detected by sophisticated DNA chip technology (1). In the accompanying Perspective written by us before the outbreaks of anthrax, we commented on the importance of this approach to understanding disease pathogenesis and future patient care (2).

However, the outbreaks of anthrax have added a new perspective to this work. It is now clear that this approach has additional potential for early diagnosis of microbial infections. It may be possible to refine this technology to allow the detection, perhaps from a few drops of blood, of unique molecular signatures of specific genes induced in host cells by individual pathogens, whether biowarfare agents or commonplace organisms. If so, this technology could provide a specific and sensitive system for establishing the presence of infection in people at risk long before clinical signs are evident or the microorganism can be directly identified—a system that reveals the nature of the pathogen, and who is infected and who is not.

Several steps would be required to develop and institute a gene chip test for the early diagnosis of infection from bioterrorism. (i) DNA chip analyses of a greater number of pathogens will clarify whether each pathogen triggers a unique signature of gene expression. (ii) Experimental animal models could be used to determine whether the gene chip test is specific and sensitive and what tissues are optimal for testing. (iii) It would be necessary to automate the test to screen large sectors of the population. Development would clearly be accelerated by a partnership among gov-

ernment, academia, and industry. A rapid molecular test such as this would have value not only for our defense against bioterrorism, but also for the early diagnosis of any infection.

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References and Notes

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Green Invaders of the Galápagos Islands

THE CHARLES DARWIN RESEARCH STATION and the Galápagos National Park Service and their partners have a program under way to eradicate and control invasive species (1) in the Galápagos Islands (News Focus, "Galápagos takes aim at alien invaders," J. Kaiser, 27 Jul., p. 590). Invasive species are now among the top drivers of environmental change (2), causing social instability and economic hardship worldwide (3). The economic costs of invasive species to a single country can exceed US\$100 billion annually (4). Island ecosystems and small island developing states are particularly vulnerable (5).

Article 8(h) of the Convention on Biological Diversity (CBD) calls on Parties and other bodies to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species." Recent decisions

under the CBD have emphasized the need to give priority attention to geographically and evolutionarily isolated ecosystems such as islands (see <http://www.biodiv.org>). The eradication and control efforts being undertaken in the Galápagos could well serve as a model and motivation for natural resource managers and policy-makers worldwide.

Kaiser's article draws attention to the challenges of managing invasive animals in the Galápagos, but invasive plants require at least as much attention. About 600 species of alien plants have been detected in the Galápagos archipelago. These are primarily cultivated species (6) but also include plants brought in unintentionally. By 2001, 55% of the alien species did not appear to be establishing, but 45% had naturalized. Of the latter, 7% are invasive (aggressively outcompeting Galápagos endemic and native flora) and 20% are potential invasives. *Cinchona*

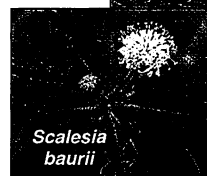
pubescens (quinine tree), *Bryophyllum pinnatum* (air plant), *Lantana camara* (multicolored lantana), *Pennisetum purpureum*



Miconia robinsoniana



Lydcopa darwini



Scaevola baurii



Pennisetum purpureum



Lantana camara

Rubus niveus

Botanical battle. A concerted effort will be needed to stem the increase of invasive plants (lower right) and their impacts on endemic and native plants (upper left and center) of the Galápagos. A Galápagos National Park Service guard (center) surveys an island of endemic *Miconia* (dark green plants) and native fern in a volcanic crater on Media Luna. The invasive plant quinine (not visible) surrounds this area.