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## Snaring hidden explosives with a neural net

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Perhaps, as one airline official suggests, the only sure way to stop the epidemic of airplane bombs is to send luggage by rail and have everyone fly naked. But a novel device that combines the precision of gamma-ray detectors and the learning ability of neural networks may offer the next best alternative.

Physicist Patrick M. Shea reported at last week's International Joint Conference on Neural Networks in Washington, D.C., that a new bomb-detection device spotted 95 percent of the simulated explosives attached to luggage in recent airport tests and mistakenly identified explosives in only 2 percent of the weapon-free luggage — half the false-alarm rate of a similar model lacking the neural network component. Shea says the detection system, known as a thermal neutron activator, represents one of the first successful commercial uses of a neural network. By late July, he and his colleagues at Science Applications International Corp. of Santa Clara, Calif., will install their device at New York's John F. Kennedy International Airport for a year's study. The Federal Aviation Administration has ordered the installation of five more of the \$950,000 detectors by January at other airports in the United States and

overseas.

Although the researchers only recently added the neural network, the bomb detector itself relies on a technique long established in nuclear physics. A cloud of low-energy neutrons bathes each suitcase moving along a conveyor belt through the machine, which is about the size of an airport X-ray detector. As atomic nuclei in the luggage absorb the neutrons, each element emits gamma rays of a characteristic energy. Analysis of the gamma rays provides an element-by-element fingerprint of the luggage contents. Researchers say the technique is particularly useful for detecting nitrogen-rich compounds, such as explosives, because neutron-activated nitrogen emits a telltale 10.8-million-electron-volt gamma ray, more energetic than that of any other element.

In 1987, the California researchers used ordinary computer logic to determine whether such gamma-ray data indicated the presence of a bomb. The device detected 95 percent of the simulated weapons in 40,000 pieces of luggage with a false-alarm rate of 4 percent. This year the group took a leap forward, inserting into its detector an electronic circuitry that mimics the connections between

nerve cells in the brain. This type of circuitry, called a neural network, can handle data on such luggage features as size, shape and weight without having to presort the information, yielding more accurate decisions about which suitcases may contain bombs, Shea says. Moreover, an additional layer of electrical connections between input and output units allows the researchers to train the system to give increasingly reliable answers after repeated trials with test luggage. "It's like hitting the network with a stick," says Shea of the training process, in which error signals provide feedback that prompts the system to adjust its electrical connections and make a better decision on the next try.

— R. Cowen

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## Chemical waves curl around tiny globes

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A barely visible streak of blue chemicals appears spontaneously at the north pole of a red, translucent globe the size of a small peppercorn. It winds southward behind the globe and emerges at the front just north of the equator. The spiraling blueness then dips into the southern hemisphere as it crosses the tiny orb's front, once again disappearing to the other side. Even before the streak spirals into itself and vanishes at the south pole, another one pierces the red—again north pole and begins its own twisting journey south.

Through a microscope, chemists Kenneth Showalter and Jerzy Maselko of West Virginia University in Morgantown spy these and even more exotic periodic chemical happenings on the surfaces of polymeric beads immersed in unusual chemical solutions. "It's a psychedelic effect," Showalter says.

The bead surfaces harbor systems of oscillating reactions that alternate between two colors. By getting the reactions to occur on spherical surfaces for the first time, the researchers can elicit behaviors impossible for such chemical systems in their more common experimental condition — spread onto a flat petri dish. The scientists report their observations in the June 22 NATURE.

For years researchers have studied these odd series of chemical reactions, which produce concentric-circular and spiral patterns that oscillate both in space and in time. The mathematical equations describing the reaction dynamics are nearly the same ones describing such phenomena as propagating flame fronts inside an engine's piston, the complex and contrary motions of a heart teetering toward cardiac arrest and the ebbs and flows of animal populations, notes Arthur T. Winfree of the University of Arizona in Tucson.

Showalter adds that studying these oscillating reactions on nonflat geome-

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## Proposal seeks wider access to AIDS drugs

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An influential federal health official has proposed easing restrictions on certain experimental AIDS drugs, a move that would allow many AIDS patients access to the latest therapies. Groups representing AIDS patients hail the proposal, but some scientists worry that patients will no longer willingly participate in clinical research trials if they can easily obtain a new drug through their own physician.

Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases, outlined his proposal last week at the HIV Treatment Awareness Week meeting in San Francisco. The plan has been well received by Food and Drug Administration officials.

Under the current system, AIDS patients can receive experimental drugs by enrolling in clinical trials designed to test the drugs' safety and efficacy. Many AIDS advocacy groups contend this system takes years and excludes many patients who can't meet a strict study protocol.

Fauci's plan would not supplant FDA's evaluations of experimental drugs but would create a separate program under which doctors could give AIDS patients certain experimental treatments approved by FDA on a case-by-case basis. Drugs in the program would have to pass FDA's Phase I toxicity evaluation but

would be available for general dispersal while FDA continued to test the experimental drug's efficacy in a Phase II clinical trial.

Fauci's spokesman says many details of the plan have to be worked out, including safeguards to protect patients from hastily approved drugs that later prove unsafe.

Drug researchers worry that such a plan might mean a dearth of clinical trial participants. Fauci says he believes some AIDS patients will continue to participate in clinical trials in the hope that rigorous monitoring will translate into better health care and a better prognosis.

FDA this week put Fauci's plan in action by allowing wider distribution to AIDS patients of r-erythropoietin, an experimental drug undergoing tests as a treatment for the severe anemia suffered by some AIDS patients who are taking zidovudine, commonly known as AZT.

Also this week, the General Accounting Office (GAO) released a report contending that methods used to gauge the U.S. AIDS epidemic greatly underestimate the number of people who will develop the disease. Although statistics vary widely, the Centers for Disease Control in Atlanta projects that cumulative AIDS cases will total 185,000 to 320,000 by the year 1991. GAO's research suggests the number will be closer to 480,000. — K.A. Fackelmann