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REAL-TIME VIDEO TRACKING SYSTEM SHOWS POTENTIAL AS A BIOMEDICAL ANALYSIS TOOL

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A video tracking system that records the movement of plant parasites could also be used to study the body's immune system, reproduction, or pedestrian traffic, a researcher at the Georgia Institute of Technology reports.

"Since the system works with a video camera, it may be used to study anything that can be visualized in high contrast, such as single cells," said Biology Professor Dr. David B. Dusenbery of Georgia Tech. "You could even look at people walking through a plaza."

Dusenbery developed the video system to track nematodes, the microscopic round worms that infect more than 2,000 plant varieties and destroy an estimated 10 percent of all U.S. agricultural crops every year. By understanding nematode behavior, Dusenbery explained, it might be possible to prevent crop damage -- or use nematodes to test industrial chemicals for toxicity.

Nematode behavior has been successfully tracked by the video system. For example, Dusenbery has shown that the root-knot nematode is apparently attracted to carbon dioxide exuded by plant roots (Journal of Chemical Ecology, Vol. 13, No. 4, 1987).

To survive, young nematodes must locate a host plant, and it's still unclear exactly how the search begins. In an effort to shed light on this mystery, Dusenbery programmed his video system to calculate the nematodes' average rate of movement and the number of directional changes caused by certain forms of stimulation. When exposed to various levels of carbon dioxide, nematodes invariably began moving more quickly, and they changed direction less frequently. In other words, they seemed to receive orientation signals from the carbon dioxide. Dusenbery has been trying to identify the exact components of the chemical mixture that is thought to attract nematodes. The information might help produce plants which avoid infestation by producing a chemical repellant.

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In related studies, Dusenbery used the video system to test nematodes' responses to potentially toxic substances (Model Systems in Neurotoxicity: Alternative Approaches to Animal Testing, by Alan R. Liss, 1987, pp. 163-170). Since the nematode has a simple, well-characterized nervous system, Dusenbery believes it might be ideal for quickly conducting preliminary toxicity tests -- while avoiding the cost and controversy associated with animal studies.

Several hundred nematodes or other subjects can be tracked simultaneously by the video system. In the case of nematodes, the subjects are placed on a specimen slide beneath the camera, which is linked to an IBM microcomputer via an Imaging Technology interface. The location of subjects is detected as video pixels brighter than an appropriate threshold, displayed on a color monitor, explained graduate student Steve Donkin. A computer analyzes the average rate and direction of locomotion for each subject.

Whenever a nematode moves, the system initiates a search of adjacent pixels in an ever-widening circle. Once a bright pixel is located, the nematode's new location is recorded.

With slight modifications, Dusenbery said, the video system could assist a variety of research efforts. Specifically, infection-fighting macrophage cells might be placed under a microscope and then tracked by the video system as they move toward foreign particles, thus revealing valuable information about the body's immune system.

"Macrophage cells use chemical signals to find these foreign particles," Dusenbery said. "So one could use the video system to study the efficiency of these cells, and the mechanisms by which they respond to chemical stimuli."

Bacteria could be studied in much the same way, he added. Other applications include reproductive or birth control research, perhaps to study the fertilization process. To perform urban planning or sociology studies, Dusenbery said, the camera could be affixed to a tall building, for tracking traffic flow and pedestrian movement.

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