

# GEORGIA TECH RESEARCH

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## News Release

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**PUTTING THE HEAT  
ON ARSONISTS: MACRO-PROGRAMMING  
AUTOMATES ANALYSIS OF FIRE DEBRIS**

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Researchers from the Georgia Institute of Technology and the University of Alabama have developed a new tool that offers investigators an edge in the battle against arsonists.

Dr. Wolfgang Bertsch, associate chemistry professor for the University of Alabama, and Dr. Gunther Holzer, associate biology professor with the Georgia Institute of Technology, have devised a macro-programming system to help interpret data from gas chromatography - mass spectrometry analysis. By meticulously charting the chromatographic composition of five different classes of accelerant substances commonly used by arsonists, Bertsch and Holzer have automated the analysis process, allowing investigators to compare known substance profiles with fire debris samples.

In a recent issue of the scientific journal American Laboratory, the researchers note that automation of chromatogram recognition improves the accuracy of fire debris analysis by reducing the element of human bias. Since accelerants often contain a complex mixture of individual components, automation standardizes and simplifies the evaluation procedure. Holzer and Bertsch have reported that the data produced are highly reliable.

This new data processing software performs macro-programming, thus eliminating the number of commands which must be entered on the computer to complete each task. Simply touching a single key can initiate a complex series of pre-determined tasks written into a macro-program.

"Macro-programming allows you to string together different commands in a sequence," Bertsch explained. "It's like telling a robot, 'Pick up a cup, get a spoon, add coffee, add sugar --' you build a process by following sequential steps."

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Macro-programming is inherently complicated, and recording the chromatographic profile of so many substances was an especially challenging task because of the complex nature of accelerants.

"Before we got to the point of writing the software, we had to look at many substances," Bertsch said. "We had to burn everything in sight." Many substance samples were burned to make sure that common building materials, such as carpet or household furnishings, would not produce interferences, Bertsch explained.

Investigators detect specific substances in fire debris by using analytical instrumentation known as gas chromatography - mass spectrometry. Gas chromatography is a technique that separates a complex mixture into its individual components. Mass spectrometry helps identify the chemical structure of each separated component.

A combination of gas chromatographic and mass spectrometric analysis may reveal exactly what type of accelerants were used to set a fire. But these scientific instruments are expensive, and only a handful of laboratories use them routinely for fire debris analysis, Holzer said. In addition, these methods are highly complex, and they require expert interpretation because each substance found in fire debris may include hundreds of individual components.

Using macro-programming, Holzer and Bertsch have examined the composition of many different accelerants, as well as common household materials.

Originally, Holzer said, the program was developed for the classification and identification of micro-organisms, based on the distribution of cellular components, such as fatty acids. After chromatographic separation of the sample components into individual substances, the pattern is examined by a peak-search routine, which verifies the presence of certain target components using mass spectral data. Once identified, a component becomes part of the sample data matrix, which in turn is searched against a library to establish similarities with patterns of known samples. The researchers inject an internal standard into each sample so that the program automatically corrects itself if it detects erratic variations from the profiles.

Bertsch and Holzer are writing a book with help from recent University of Alabama graduate Dr. Suzanne Sellers.

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