# SEARCH FOR IDENTITY

*Dental filling fragments can provide forensic clues*

By Lois Baker

PHOTO BY NANCY PARISI

**Peter Bush and Mary Bush, DDS, have recognized that dental resins hold forensic clues.**

When an explosion or accidental cremation occurs, or a criminal deliberately sets fire to a body to destroy it, **precious little may remain** to link investigators to a life once lived.

Yet a team of forensic dental researchers at the University at Buffalo has shown that, even **among the ashes, evidence exists** that can help identify human remains when all else—flesh, bones, teeth, DNA—is lost.

The evidence can be hard to recognize, but **it is distinctive.**

**IN A SERIES OF EXPERIMENTS** reported in the May 2006 and January 2007 issues of the *Journal of Forensic Science*, the researchers show for the first time that inorganic resins that make up the central matrix of tooth-colored dental fillings can withstand temperatures of 1,800 degrees Fahrenheit and can be recovered and named by brand or brand group.

Even when only fragments of resin could be found, the researchers were able to classify the composition of elements in the filling. Comparing those elements and their proportions to the composition of the known filling brands recorded in a deceased's dental chart could, under the best circumstances, help identify the remains unequivocally.

At the very least, the analysis could determine if the filling material was or was not consistent with the person's dental records.

Mary A. Bush, DDS, assistant professor of restorative dentistry in the UB School of Dental Medicine and lead author on the studies, says this new type of evidence could have a major impact on forensic dentistry.

"To date, no one has recognized that many modern restorative resins have unique characteristics that can be distinguished and used for forensic identification," notes Bush. "And nobody has applied the standard analytical methods that we have at UB to survey these materials and determine these properties."

Peter Bush, director of the instrument center where much of the research analysis was conducted, was a major contributor to the research, as was forensic dental expert Raymond Miller, DDS, clinical assistant professor of oral diagnostic sciences, and Jennifer Prutsman-Pfeiffer, anthropologist and UB doctoral student.

The team's work has yielded unexpected rewards. The FBI has offered to include the information in their database, and the American Society of Forensic Odontology has provided a grant to help assemble the data.

"The importance of identifying these properties is, first, to show that it can be done," says Bush, "and, second, that it can be done even after extreme events such as mass disasters, plane crashes or explosions."

The 1999 trial of Donald Blom, accused of killing Katie Poirier after abducting her from a Minnesota convenience store, demonstrated the usefulness of such forensic evidence in homicide investigations, as well. Blom confessed to the crime, but later recanted. The body was never found; however, human bone fragments and a single tooth were unearthed in a burn pit on Blom's vacation property. Analysis of the components of the tooth's filling material matched the brand of filling recorded in the victim's dental records, evidence that helped put Blom in prison for life.

Bush and colleagues began their experiments in 2005, using UB's specially equipped instrument center, which includes scanning electron microscopy/energy dispersive X-ray spectroscopy equipment, known as SEM/EDS, and a portable X-ray fluorescence (XRF) unit to conduct material analysis outside the lab.

In their studies, the scientists had access to cadavers through the School of Medicine and Biomedical Sciences' Anatomical Gift Program, to which persons donate their bodies for use in teaching and scientific research.

In the initial experiments, which were carried out with teeth only, the investigators created disks of 10 different resins used for standard tooth fillings to serve as controls, then filled extracted teeth with the resins and incinerated them in an oven for 30 minutes at 1,652 degrees Fahrenheit.

These conditions were more extreme than in a standard cremation, Bush notes, because teeth normally would be protected by flesh and bone, allowing them to withstand the high temperature for a longer period of time. With no such protection, the extracted teeth fragmented in half-an-hour.

Dental resins consist of an organic matrix surrounding inorganic filler particles. "At these high temperatures, everything organic is destroyed," explains Bush. "It was the inorganic material that was recoverable."

After retrieving the resin fragments, the team analyzed their elemental composition using SEM/EDS. In the May 2006 issue of the *Journal of Forensic Science,* they reported that they were able to identify the concentration and microstructure of the inorganic elements in the fragments and link them to the specific brand or brand group of the material documented in the controls.

"Not only do these materials have various microstructures," says Bush, "they also have unique elemental compositions, which make it possible to distinguish between brand or brand groups. We showed that the elemental distinction remains even after extreme conditions such as cremation."

**TO CREATE A TRUE-TO-LIFE** scenario, the team worked next with cadavers donated to the medical school's Anatomical Gift Program, with full approval from the university's Human Subjects Review Board. They removed all existing resin fillings from the teeth of six cadavers and replaced them with a total of 70 fillings representing five different resin brands. The filling brands used were recorded in each cadaver's dental record.

With the new fillings in place, the bodies were put through the standard two-step cremation process: very high heat (1,800 degrees Fahrenheit) for two and a half hours, which destroys all flesh and small bones, then crushed in a grinder and reduced to ashes.

Bush and colleagues were able to find and identify enough of the resins to make a positive identification of each cadaver, using the portable XRF unit to mimic investigations that need to be conducted in the field.

The results of this study appeared in the online version of the *Journal of Forensic Science* in December 2006 and were published in the January 2007 print issue.

"Even in the ashes, we were able to retrieve small pieces of resin and distinguish between cadavers," reports Bush. "To my knowledge, this is the first time this type of analysis has been done. This study provides hope of identification when little hope may be present.

"If an individual isn't burned to this extreme and the teeth are intact but the dental X-ray comparison is questionable or teeth are fragmented, this type of analysis can give another level of certainty on which to base an identity," she says.

XRF doesn't provide as much information as the lab-based SEM/EDS equipment, Bush adds, but its speed compensates for lack of precision. The device can identify the chemical spectrum of elements in inorganic material in 6 to 10 seconds, providing quick on-site screening of suspected material.

The ability to distinguish between resins gives investigators a new tool for use in special circumstances, Bush concludes.

**"The importance of identifying these properties is, first, to show that it can be done," says Bush, "and, second, that it can be done even after extreme events such as mass disasters, plane crashes or explosions."**

**The team's work has yielded unexpected rewards. The FBI has offered to include the information in their database, and the American Society of Forensic Odontology has provided a grant to help assemble the data.**

"Retrieving small amounts of resin as we did in this study would not carry as much weight for identification as a dental chart comparison, but the evidence was indisputable and unequivocal. This evidence would serve as an aid in identification when very little other evidence exists or when added scientific corroboration is needed."

Bush and her coinvestigators currently are working with the FBI to construct a database of the most common brands of dental restoration materials and their elemental composition for use in criminal investigations.

"There are more than 50 filling materials on the market today," explains Bush. "We have analyzed the 30 most popular resins and 23 historical resins dating back to 1971. There are also many other unique dental materials—posts, cements, crowns, sealers—which also will be included in our database. Again, no one else has attempted such a comprehensive survey of their properties."

The database does have limitations: It will be useful only if dentists document all dental restorations, including brand names, in their dental records, notes Bush.

The UB researchers will have a role in bringing that point home to their colleagues and dentists-of-tomorrow through the new Laboratory for Forensic Odontology Research housed in the UB School of Dental Medicine. Bush will direct the laboratory, with Miller as codirector.

The laboratory will host demonstrations and seminars on forensic dentistry for students and feature lectures and continuing education programs in forensics for practicing dentists. BP

# Distinguished Medical Alumna

*Elizabeth Pierce Olmsted Ross, MD '39*

**Elizabeth Pierce Olmsted Ross, MD '39,** pioneering ophthalmologist, nationally recognized advocate for the blind and visually impaired and philanthropist, is the recipient of the University at Buffalo's 2006 Distinguished Medical Alumnus Award.

A dinner in her honor, hosted by the School of Medicine and Biomedical Sciences and the Medical Alumni Association (MAA), was held October 27, 2006, at the Buffalo Club. In attendance were MAA officers and other alumni, Dean Michael Cain, MD, faculty and friends of Olmsted Ross.

Olmsted Ross was one of four women in a class of 64 to receive her medical degree in 1939. While still in medical school, she began flying planes as a hobby, becoming one of the first female pilots in Western New York. During World War II, she served as a medical officer and flight instructor, obtaining the rank of lieutenant in the Civil Air Patrol and serving as a member of the Ninety-Nines, the international organization of female pilots.

As an intern, she pursued a career in aviation medicine, which at the time was founded on eye tests. She enjoyed the training in ophthalmology and decided to pursue residency in this field, a decision that proved challenging. Women were not usually admitted to ophthalmology, since in most hospitals the specialty fell under a surgical residency, a field dominated by men. This changed with the start of World War II, as hospitals needed women to fill the vacancies created by male physicians drafted into war. Olmsted Ross completed her residency training in Chicago at the Illinois Eye and Ear Infirmary.

Olmsted Ross was the youngest person on record to be named diplomate of the American Board of Ophthalmology. As the first female ophthalmologist in Buffalo, she opened a private practice in 1944. Soon she was subcontracting with various local industries, beginning a long career of patient care, advocacy and research. Olmsted Ross initiated safety goggle programs and industrial lighting standards at Curtiss Wright Corporation. While working to fit engineers with protective eyewear at Cornell Aeronautical Laboratory, she listened to their concerns about working with a new technology called radar. She spent the next three years investigating the ocular effects of radar exposure and related issues with studies conducted at Tufts University, Griffiths Air Force Base, Cape Canaveral and aboard the RCA radar ship patrolling the East Coast.

During the 1950s and 1960s, Olmsted Ross established an accredited ophthalmology program at Deaconess Hospital, which involved the relocation of the Wettlaufer Clinic—the largest eye clinic in the city—to the hospital. She was chair of the Wettlaufer board and created the preschool vision screening clinic in Buffalo public schools by training Junior League volunteers to conduct eye exams. Additionally, she developed and introduced large-print books to area libraries.

Olmsted Ross has been associated with the Blind Association of Western New York since she began her practice. In 1999, she made the agency a gift of $1 million to renovate the facility, the largest gift ever made by an individual to the agency, which now bears her name: The Elizabeth Pierce Olmsted, M.D. Center for the Visually Impaired. People from around the world come to participate in the services provided, to obtain training and job skills and to learn solutions to the challenges they face living with impaired vision.

In the fall of 2003, Olmsted Ross offered a $3 million challenge grant to UB to establish the Ira G. Ross Eye Institute, the research and teaching affiliate of the center named in honor of her late husband; upon its successful conclusion, she made an additional $1 million challenge grant. The institute will be an important element of the Buffalo Niagara Medical Campus, a world-class facility located in downtown Buffalo (see related story on page 40).

A recipient of many awards for career accomplishments, Olmsted Ross was inducted into the Western New York Women's Hall of Fame in 2002 and received UB's prestigious Samuel P. Capen Award in 2005 for "meritorious contributions to the University at Buffalo." BP

—Kathleen Wiater

**LEFT TO RIGHT: Michael E. Cain, MD, dean of the School of Medicine and Biomedical Sciences; Elizabeth Pierce Olmsted Ross, MD '39, 2006 Distinguished Medical Alumna; and Martin C. Mahoney, MD '95 PhD '88, president, Medical Alumni Association.**

# Changes in Residency Programs

**In September 2006, University at Buffalo announced significant changes in two of the 64 residency training programs that it operates jointly with area hospitals.**

**The formerly suspended training program in otolaryngology is being reestablished, and the residency in radiology will be closed.**

**The university will voluntarily withdraw Buffalo's radiology residency training program from the national accreditation process conducted by the Accreditation Council on Graduate Medical Education (ACGME). The decision to take this step was reached following extensive internal reviews, an on-site assessment by an independent panel of nationally recognized leaders in radiology education and with the full concurrence of Kaleida Health, Roswell Park Cancer Institute, and the Buffalo Veterans Affairs Western New York Healthcare System, the current radiology residency training sites.**

**David L. Dunn, MD, PhD, UB vice president for health sciences, said the radiology residency cannot meet accreditation criteria with its current structure. Similar problems, he added, are being faced by nearly one-third of the radiology residency programs in the country.**

**Of the 773 residents in training programs overseen by UB, 14 are in the four-year radiology residency that will cease operation at the end of the 2007–08 academic year. The office of Graduate Medical Education in the School of Medicine and Biomedical Sciences will provide assistance and oversight for an orderly transition as residents in the program complete their training here or are placed in accredited programs elsewhere in the U.S.**

**Since several components of the radiology residency were judged to be of high quality, UB and its partner organizations plan to develop a new radiology training program with a structure designed to meet the accreditation criteria of the ACGME.**

**Dunn said UB is confident that the withdrawal will not impact the excellent training in radiology provided to UB medical students or care provided to patients in the community.**

**"The UB School of Medicine and Biomedical Sciences effectively managed a similar situation with the otolaryngology residency program in 2002 and is pleased to announce the new residency program in this specialty, which has been accredited by the ACGME after being restructured under the new leadership of Dr. David Sherris," Dunn said.**

**The new residency program in otolaryngology replaces one that was disbanded in June 2002 due to inadequate funding for a chairman (the program was not threatened with losing accreditation). Residents are being recruited for the new five-year program, which will begin in July 2007.**

**"UB and its hospital-system partners are committed to presenting the highest-quality residency programs across the board to train new physicians, many of whom will remain in the area to meet the health-care needs of Western New York residents," he added.** BP

—Arthur Page