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Alumni profile: Dr. Martin D. Levin, D'72, GD'74

Using High-Tech Tools to Investigate 400-Year-Old Jamestown Remains

THE SERVANT BOY was little more than 15 years old and had endured an arduous five-month journey across the Atlantic Ocean. Then, just two weeks after landing at James Fort, he was killed by the Virginia Indians under Chief Powhatan while planting corn in a field.

His short life, which came to an end in 1607 in what is now Jamestown, Virginia, may have ended tragically, but now, more than 400 years later, his remains, and in particular his teeth, are yielding new clues about what life was like for early colonists in the New World.

A central character in this true-life mystery is Penn Dental Medicine alumnus Martin Levin (D '72, GD'74), who has had an endodontic practice in Chevy Chase, Md., since 1975. "Many times, the only remains of early settlers are their teeth," says Dr. Levin. "The enamel and dentin is more resistant to the breakdown that bones succumb to, and soft tissue goes away quickly."

TOP: Dr. Levin adjusts a digital sensor to image the maxillary left region of the Jamestown specimen. (photo by Bruce Dale)

Dr. Levin's involvement in this historic project started with a visit about five years ago to the Smithsonian National Museum of Natural History in nearby Washington, D.C. to view the exhibit "Written in Bone, Forensic Files of the 17th Century Chesapeake." It featured the work of the Jamestown Rediscovery project, which is preserving the historic site — the first permanent English settlement in North America — through archeological and scientific investigation.

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When Dr. Levin first saw the skeletal remains of the teenage boy at the Smithsonian Museum, his skull revealed a fractured mandibular incisor that had led to an infection and large abscess. The exhibit indicated the fracture had likely happened during the voyage across the ocean.

Observing the size of the apical lesion and wear on the fractured tooth, Dr. Levin questioned the timing of the trauma and resulting abscess, believing that the injury had occurred long before the ship left England.

Curious by nature and technologically astute, Dr. Levin thought there could be more stories those teeth could tell about this particular boy's life in England and the new colony. With the visit fresh in his mind, he called the exhibit curator, Dr. Douglas Owsley, Division Head of Physical Anthropology at the Museum of Natural History, who, along with Michael Lavin, Director of Collections and Conservation at Jamestown Rediscovery, agreed to have Dr. Levin further examine the skull and teeth when the exhibit came off display the following year.

The boy, officially identified as JR1225B by the Jamestown Rediscovery staff, was one of 104 passengers 100 men and four boys — on three ships that left England to establish a business outpost in the New World for the Virginia Company of London. These early settlers endured harsh conditions — disease and starvation, as well as attacks from the native Virginia Indians. Within a year, almost half of the original settlers were dead.

Dr. Levin says once the "invaluable remains" were in his office, he was able to examine the boy's skull and teeth utilizing cone beam CT, perform a microscopic examination, and take a full-mouth series of radiographs. The resulting studies not only showed that the tooth had been fractured about eight years earlier than previously thought, but it was a repository for impacted food over that time.

What more could this tooth tell them, he wondered? Dr. Levin proposed removing the impacted food and infected tissue from the root canal on the 400-year-old tooth for analysis. During a six-hour procedure in a clean-room, he painstakingly removed the root canal contents of the fractured tooth in 12 sections at different layers. Most of the samples have been preserved for later study, with the notion that future technological advances may yield even more information.

To help with the analysis, Dr. Levin enlisted the help of experts, including D. Joshua Cohen, MD, a biomedical engineer at Virginia Commonwealth University's Nanomaterials Characterization Core, where micro-CT, scanning electron microscopy and energy dispersive X-ray spectroscopy technology were used to assess size, shape and volume of the particulate matter. Barry Pass, DDS, PhD, an oral and maxillofacial radiologist, also provided additional interpretation of the radiographic imaging.

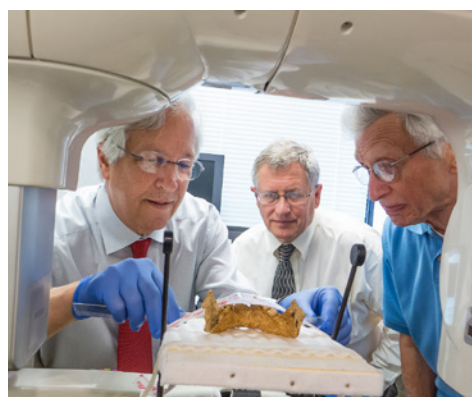
Other collaborators included Dr. Janet Monge, Curator-in-Charge of the Physical Anthropology Section in the Penn Museum and Adjunct Professor, who has experience in skeletal biology and dental histology.

A trip to Colorado brought Dr. Levin and some of the team to the Paleo Research Institute, where archaeobotanist Linda Scott Cummings identified the fibers, pollen and food particles that had been packed into the root canal that Dr. Levin had emptied. Grain remnants that could not have been from the New World reinforced the finding that the injury had happened years earlier. Evidence of corn indicated the boy might have been eating some of the corn he was planting in the Virginia field. Cotton fibers also were found — a possible attempt by the boy to protect the exposed canal from food impaction. Michael Lavin, of Jamestown Rediscovery, says Dr. Levin's curiosity based on his astute observations at the Smithsonian exhibit helped jumpstart these additional layers of research on the boy who was killed just weeks after landing on Virginia soil. He says Dr. Levin, who is currently helping to research the remains of what are believed to be those of Sir George Yeardley, Lord Governor of Virginia, is "one of first phone calls I make if I have any questions of a dental nature."

TOP: Drs. Monge and Levin (left to right) impress the molars of a specimen believed to be Sir George Yeardley at Jamestown.

BOTTOM LEFT: The mandible of the Jamestown specimen is positioned by Drs. Levin, Owsley and Pass (left to right) on a special cradle for CBCT imaging in Dr. Levin's office. (photo by Bruce Dale)

BOTTOM RIGHT: The Jamestown specimen positioned for digital imaging in Dr. Levin's office. (photo by Bruce Dale)



For his part, Dr. Levin says he is thrilled that his knowledge and advanced dental technology has enabled him to help archeologists and historians learn more about what life — and death — was like for these early settlers.

"We are stewards of these sites," Dr. Levin says. "These specimens belong to America, and we must make sure care is taken so the best science is used."

While pursuing this newfound passion for forensic odontology, Dr. Levin continues to maintain strong ties with Penn Dental Medicine as well, and throughout his career, he has served in a number of leadership roles at the School. He currently serves as Chair of the Dean's Council, as well as an Adjunct Professor in the Department of Endodontics. He was also on the Board of Overseers for more than 10 years, including three years as Chair

(2005 to 2008), and remains an ex officio member. In addition, Dr. Levin served the American Association of Endodontists as Co-Chair of the Joint Special Committee of the American Association of Endodontists and the American Academy of Oral and Maxillofacial Radiology on the use of Cone Beam Computed Tomography in Endodontics.

As a result of the many connections he has made through the Jamestown project, Dr. Levin adds that he is exploring with Penn Dental Medicine and the University of Pennsylvania Museum the possibility of these schools cohosting an international symposium on forensic odontology. "It's a fascinating field," he says. "While we are just beginning discussions on a symposium, I hope we can bring together leaders in the field to share their expertise." ■

— By Debbie Goldberg