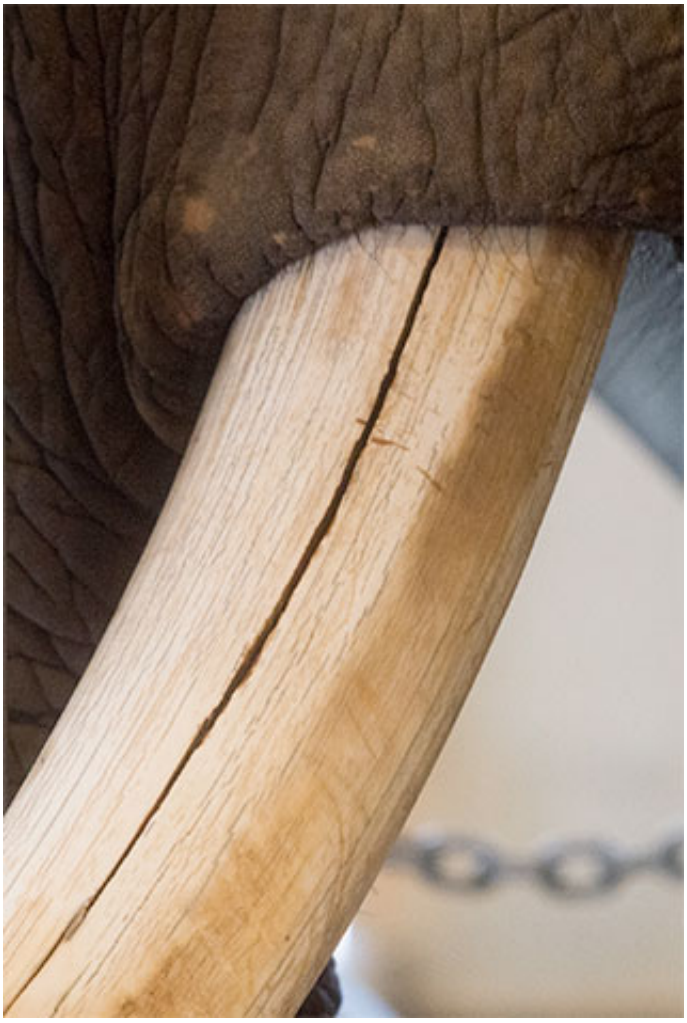
Engineers develop new method to repair elephant tusks

November 18 2015, by Katherine Shonesy



A cracked tusk can become infected and pose problems for an elephant. Tusks with cracks that are left untreated may ultimately have to be removed.

When Birmingham Zoo veterinarians approached researchers from the University of Alabama at Birmingham School of Engineering to help them stop a crack from growing in their oldest elephant's tusk, the engineers saw an opportunity to use their expertise in materials science to improve the industry standard for the repair process.

Cracks in elephants' tusks have historically been repaired by adhering a metal ring to the tusk in order to stabilize the crack and prevent it from growing any farther up the tusk.

The Birmingham Zoo asked the director of UAB's Materials Processing and Applications Development Center, Brian Pillay, Ph.D., to do just that, for Bulwagi, a 35-year-old male African elephant in their care.

Pillay's immediate response was to innovate the process, and apply some of the science the lab uses in other materials processes to create a new, more robust and seamless treatment for the crack.

"When the team at the Zoo asked me to create this metal ring, I thought, 'we can do better,'" Pillay said. "We can use what we know about materials development to make something that will work better for the elephant."

"This is something that's bridging the gap between what Dr. Pillay's lab does working with industrial settings and what we do working with a biologic situation," said Richard Sim, DVM, associate veterinarian at the Zoo. "It's a first of its kind in that way—combining engineering that would normally be used in structures like bridges and applying it to an elephant."

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"An open crack is a site for infection, as a tusk is basically a tooth," Pillay said. "Imagine having a crack in your tooth—it's rather painful for the elephants as well."

The Zoo's team of veterinarians, animal care specialists and curators worked with students and researchers from UAB to prepare, then apply, the composite fiberglass and carbon-fiber band and resin on Bulwagi's tusk.

"We worked with Dr. Pillay's lab to practice applying this product on a PVC pipe to start off with as a model," Sim said. "I went down to the UAB lab on two occasions to really try to hammer out the details of how this was actually going to work. The first time I went down, we had a very successful practice session; but our idea of how we were going to apply it to a real-life setting was just not going to work for the elephant."

Through training with MPAD staff engineer Ben Willis, Sim and Pillay's team worked to perfect the process, and the end result was successful.

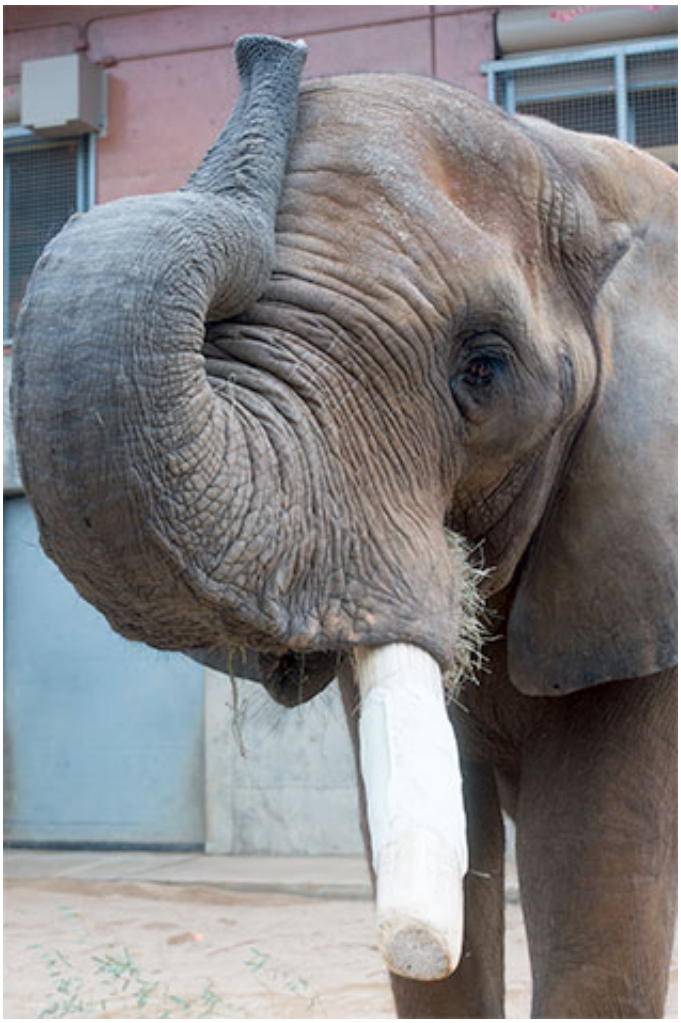
"We put a number of layers of carbon fiber and fiberglass around the tusk, and then used a vacuum pump to suck the resin, kind of like an epoxy, up into that product, and it set and became a really hard structure that is going to resist the forces that resulted in the crack," Sim said. "No one has done this before, so it's our hope that this will be a process that will stand the test of time."

"It's the latest in technology, and it's a great deal lighter, stronger and tougher than steel," Pillay said. "The standard ring that would have been traditionally used is four to five times heavier than what Bulwagi has now. This is a significantly better solution."

Tusk cracks are fairly common in elephants, because a great deal of pressure is put on the tusk as the elephants use them to interact with their

environment and other elephants, so the repair process is something that will always be in demand.

While Bulwagi may eventually lose his tusk because of the progression of this particular crack, UAB and the Zoo sought to use this development process as a way to help other elephants in the future.



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"Our hope is that we came up with something that will help a lot of elephants moving forward," Pillay said.

The team's next step is to wait and see how, and whether, the crack continues to develop over time, to evaluate how their creation will work for other elephants.

"Right now it's just a waiting game, but we feel good about what we created and are looking forward to seeing if it can help other elephants," Pillay said. "We're hopeful that when vets first observe cracks, they will be able to go in and replicate this procedure to prevent the cracks from growing any farther and save the elephants' tusks."

Regardless of the outcome, this project has served another purpose—fostering collaboration between two Birmingham organizations.

"Having a partnership with the Greater Birmingham area is a model we use in caring for our animals," Sim said. "It can only benefit us by employing the expertise of our community to help with issues that are outside of the scope of what we can do here."

"It's a perfect partnership, with the Zoo's environmental responsibility to protect and care for the animals," Pillay said. "At UAB, we do a lot of work in terms of human care; but it's great to be able to take some of that technology and apply it to the animal world.

"Working with the Zoo to innovate and create something that serves to benefit animals has been tremendously rewarding for our team of researchers and students. For our students, specifically, it's opening their eyes to how diverse the engineering industry can be. Being able work on a project like this as undergraduate and graduate students has been invaluable for their career development."

Provided by University of Alabama at Birmingham