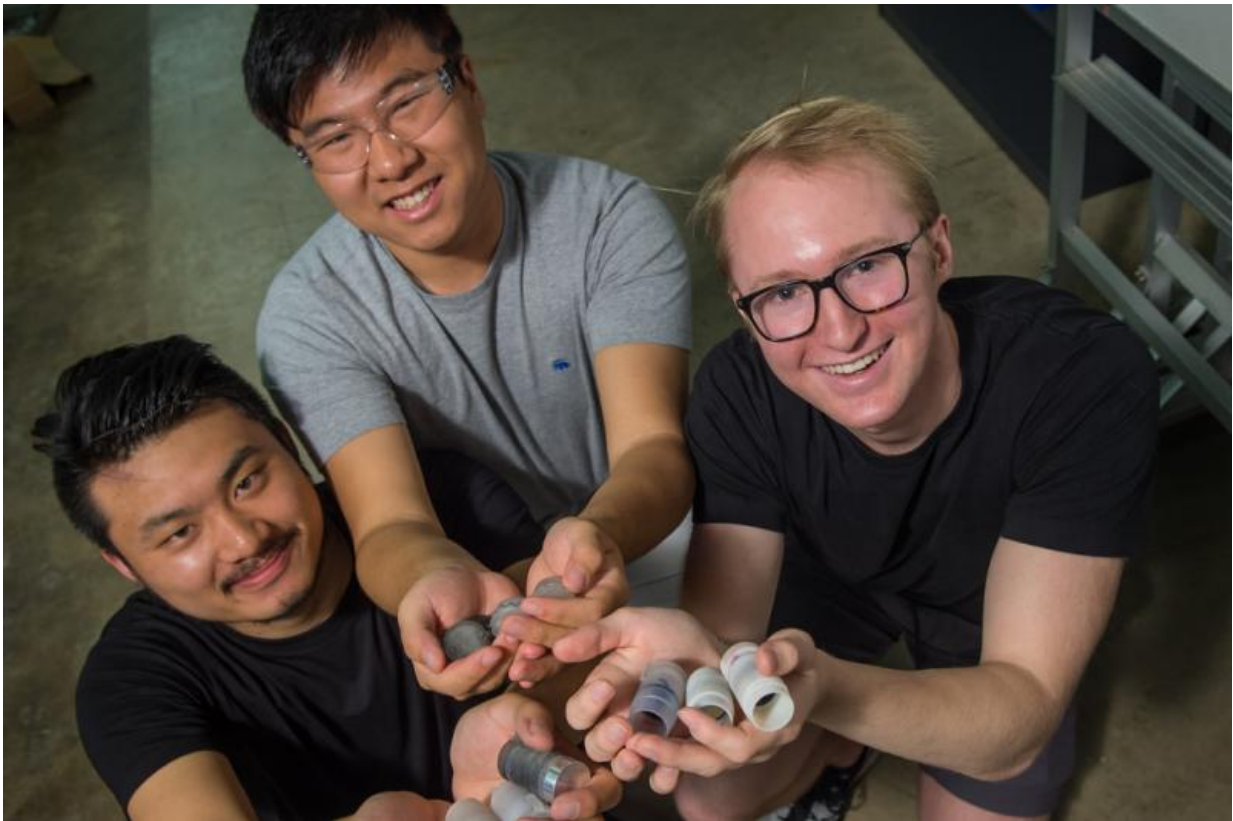


Students work to ease the pain of needle injections

April 15 2015, by David Ruth



Credit: Rice University

If the Rice University freshman engineering design team Comfortably Numb has it their way, children will be less fearful and feel less pain when they go to the doctor's office for a shot.

The trio of freshmen has created a [device](#) to ease the pain of an injection. Their device numbs the skin prior to a shot by producing a [rapid chemical reaction](#) to cool the patient's skin.

The team, made up of computer science major Greg Allison, bioengineering major Andy Zhang and [mechanical engineering](#) major Mike Hua, currently has a functioning prototype that has shown to produce a measurable numbing effect in 60 seconds, which in turn reduces the pain from an injection.

"Our (lab) device is 3-D-printed and consists of two sealed chambers containing the chemical ammonium nitrate and water," Hua said. "A simple twisting motion moves the chambers into alignment to allow the chemicals to flow through the chamber to produce a rapid endothermic reaction. We then numb the skin by contacting the device's metal surface to the patient's skin."

The team said that current solutions are either ineffective, because they don't numb well enough, or they take too long. The team noted that a commonly used medicated topical patch takes about an hour to work. "Our solution works on the order of seconds and minutes," Zhang said.

"We are targeting anyone who has to get an [injection](#), which is nearly everyone," Allison said. "But the device is especially applicable to people who are more susceptible to pain," such as the elderly and children, he said. He also said it's intended for use during procedures "where you have to get shots in more sensitive areas of the body, such as the face or the groin."

The team also recognized that other applications of this project could be ear piercings, swelling reduction and tattooing, although they are currently not addressing them at this phase.

"We looked into all sorts of methods for numbing, both quick and long-term, chemicals, using ice packs—which is similar to what we're using now," Hua said. "We explored everything that surrounded the problem before we even began brainstorming."

"At the end of the day, what we're creating is a self-contained device with a very cold contact surface, and there are many applications for that," Allison said.

Some of the solutions the team researched were very technical and required a materials science degree or skills the freshmen hadn't yet learned. "That's kind of the amazing thing about our project because we don't have these incredibly refined skills in certain areas; that meant that we had to think of very simple solutions," Allison said. "Being limited in that way led to something that is very novel and innovative but at the same time simple and elegant.

The team designed the device to be single-use rather than reusable because cleaning it for each use and resetting the device would be cumbersome for a nurse, and injections are such a common procedure that it's much easier to have a single-use device.

"We've done simulated trials where we basically hold a pen up against a ruler and press down 5 millimeters—we know what that feels like—apply the device, press it down 5 millimeters again and gauge based on the comparative pain scale, which is something hospitals already use," Allison said.

"The materials that we use are relatively inexpensive and found in abundance: plastic, rubber and metal," Zhang said. "The materials for one of these cost about a quarter, and then we just had to do estimates based on how much manufacturing would cost. We compared our device to similar things already in production, and we've estimated the cost at

about \$2."

Comfortably Numb was guided through its design project in Rice's Oshman Engineering Design Kitchen in the fall semester by Ann Saterbak, Bioengineering's director of laboratory instruction, and in the spring semester by Jane Grande-Allen, the Isabel C. Cameron Professor of Bioengineering.

"We meet with Dr. Grande-Allen every Tuesday," Zhang said. "We show her our progress and bounce ideas off of her. A lot of our ideas came from our discussions with her, especially the use of chemicals. She actually let us into her lab and had her graduate students help us create these (chemical) reactions to see what was truly going on and for us to understand the reactions."

The team is currently in the process of applying for a provisional patent for the device, and the students hope to continue their work together in their spare time when they return to Rice as sophomores.

"As a team, we just want to follow the project, because we think it has a lot of potential. I think that's what drew us to this specific project," Allison said. "We haven't really discussed yet whether we're going to dedicate to making this a company, but it's something we're open to."

Provided by Rice University

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