

3D-printed organs aid medical students



Assistant Professor Reddy Mogali, head of anatomy at NTU's Lee Kong Chian School of Medicine, with a 3D-printed heart. He said such replicas of human organs, made with 3D printers, serve as an additional learning tool for his students, who have until now been working with cadavers. ST PHOTO: LIM YAOHUI

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NTU don comes up with replicas to help them appreciate structural variations in an organ

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As a medical science student in India about 20 years ago, Assistant Professor Reddy Mogali studied the human anatomy by working on cadavers and organs donated for medical research and educational purposes.

But the head of anatomy at Nanyang Technological University's (NTU) Lee Kong Chian School of Medicine has come up with an alternative for students - replicas of human organs, made with 3D printers.

The 3D-printed specimens come in varying colours, hardness and flexibility that mimic the properties of real human organs.

Prof Reddy, 38, said having an additional learning tool, besides cadavers, would help students as they would be able to appreciate structural variations in the same organ from different individuals.

"Everyone's heart and (other organs) are different. Maybe one septum is bigger than another. If students are studying just one heart, it can be hard to understand what is being taught," he added.

Until now, students have been working with cadavers, both wet and plastinated. Wet cadavers are soft and pliable as they have been preserved in a solution called formalin.

"You can touch (the cadavers) with gloves, but the smell of formalin is not very pleasant and can irritate the eyes," said Prof Reddy.

\$6,000 Replacing one plastinated heart can cost up to this amount, while a full upper limb can cost twice that.

\$400 In comparison, the material cost of a 3D-printed replica of a heart is about this amount.

Plastinated cadavers are dehydrated specimens that have been injected with silicone. They do not smell or decay, but are more rigid than wet cadavers and can break if handled recklessly.

"It doesn't happen (break) very often but there is always that fear that you'll damage them," he said.

Replacing one plastinated heart can cost up to \$6,000 and a full upper limb (shoulder to hand) can cost twice that. In comparison, the material cost of a 3D-printed replica of a heart is about \$400.

Donated cadavers are generally in short supply. Prof Reddy said: "It is difficult to obtain them, due to ethical, religious and financial issues."

To print the three-dimensional replicas, a CT scan of the organ is first conducted. Segmentation to identify the various structures of the organ is then done on a computer, to recreate a three-dimensional image to be printed.

He has applied for know-how technology disclosure, which is the first step in getting intellectual property protection for his work. The university will then evaluate the potential of the technology.

Prof Reddy, a Singapore permanent resident, was raised in a small village south of New Delhi. He went to Sri Krishnadevaraya University, where he graduated with a bachelor's degree in chemistry, biochemistry and zoology. He did his master's and PhD in anatomy at Kasturba Medical College.

While the primary purpose of the 3D-printed models is to help his students, Prof Reddy hopes hospitals can use them too. For instance, they can be used to simulate surgery and explain a complex operation to patients before the procedure.

"Education has changed a lot since I was a student myself," said Prof Reddy. "There are different requirements and higher expectations now. But technology... can make everyone's life easier."

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