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Scientists at NTU use 3D printing to create living cells

Bio-printing seen as offering solution to shortage of suitable organs for transplants

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The days of human organ transplants may be numbered, as researchers are in pursuit of man-made tissue that can be printed on demand.

It is a future where new skin or body parts can be directly printed on to patients within minutes using 3D printers, which build objects from metals, plastics and even bio-materials to replicate human skin based on digital designs created on a computer.

The Singapore Centre for 3D Printing (SC3DP) at Nanyang Technological University (NTU) joins a pack of researchers worldwide chasing this holy grail in transplantation technology. The centre's animal tests found that 3D-printed cells from the centre were able to regenerate into new bones, paving the way for use in humans in the future.

The centre uses 3D printing technology to create living cells for tissue engineering, which is targeted to be an alternative to organ transplants, said NTU in a video about its research.

Every year, thousands of people on wait lists for organs die due to a shortage of suitable organs, it added. "Bio-printing can solve these problems by creating tissue on demand."

Bio-printing involves scanning a patient's body to create a digital model of the tissue that will be replicated.

SC3DP director Paulo Bartolo said: "Computers let us render all the complexities found in human tissue, like the channels for oxygen and hair follicles."

Cells taken from a patient's tissue are mixed with a special biodegradable

gradable gel-like substance for 3D printing, called Bio-inks, and then printed layer by layer to form an organ's structure.

Human cells can also be seeded on a biodegradable material, which acts as a scaffold for the human cells to grow around and fades over time to allow the patient's regenerated cells to take its form, said Dr Bartolo.

His team has demonstrated the method's ability to induce bone formation around 3D-printed scaffolds in mice, suggesting promising potential for human application. But this is still some ways off, he added.

Bio-printing also opens the doors to drug delivery testing as it allows researchers to observe how a patient's tissue might react to substances without putting any human at risk, said Dr Bartolo.

NTU is among a handful of institutions around the world, including Harvard University, that are finding ways to artificially create human tissue.

Established in 2014, NTU's 3D printing research centre conducts studies in additive manufacturing for fields like construction, food sciences and, in 2022, bio-printing.

It launched an official partnership with Singapore General Hospital (SGH) on Dec 4 to advance the use of point-of-care 3D printing in healthcare. It will add to SGH's 3D printing capabilities, which include printing orthopaedic implants for bones and muscles and surgical tools, to eventually offer patients personalised bio-printed tissues and more complex implants. The hospital launched its 3D printing facility in 2022.

Among the 3D printed materials that will be trialled in the partnership are porous metal implants



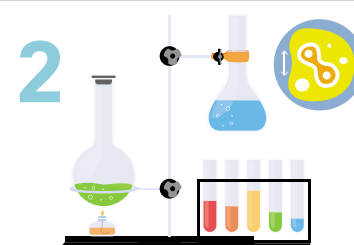
Singapore Centre for 3D Printing director Paulo Bartolo and Singapore General Hospital (SGH) Future Health System department clinical director Goh Su-Yen. The centre launched an official partnership with SGH on Dec 4 to advance the use of point-of-care 3D printing in healthcare. ST PHOTO: NG SOR LUAN

3D-printed organs

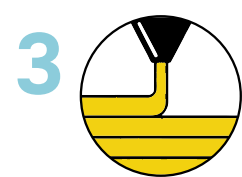
Researchers are developing man-made organs that can be printed on demand to reduce the need for organ transplants.



1 The patient's tissue is scanned and rendered digitally.

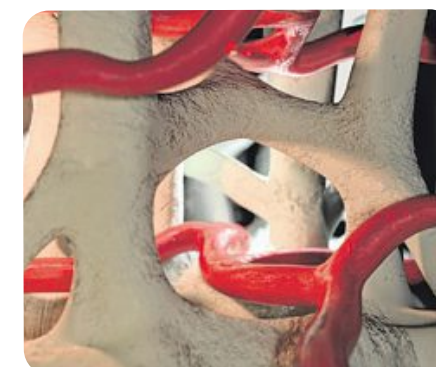


2 Cells are scraped from the patient's organs and mixed with Bio-inks, which is used to 3D-print bio-materials.



3 A biomedical 3D printer uses the Bio-inks to build the structure of the patient's replacement organs, layer by layer.

4 The patient's cells (red) are guided by the 3D-printed scaffolding (white) to regenerate the organs. The newly formed organ, such as skin or liver, will take the place of the biodegradable scaffolding, which will vanish over time.



Source: NANYANG TECHNOLOGICAL UNIVERSITY PHOTOS: ADOBE STOCK STRAITS TIMES GRAPHICS

MAKING SCI-FI A REALITY

Bio-printing is like a sci-fi story come to life. We would have the ability to print organs, which can help to replace the need for transplants.



SGH FUTURE HEALTH SYSTEM DEPARTMENT CLINICAL DIRECTOR GOH SU-YEN, who added that the partnership with NTU will help to speed up 3D printing operations and make the process more robust.

that are more flexible than traditional metal implants and reduce the chances of bone degradation.

Dr Bartolo said: "Traditional metal implants are stronger than bone. Human bones need to be stimulated, otherwise they become weakened and this can lead to bone loss."

SGH Future Health System department clinical director Goh Su-Yen said the partnership with NTU will help to speed up 3D printing operations and make the process more robust.

She added: "Bio-printing is like a sci-fi story come to life. We would have the ability to print organs, which can help to replace the need for transplants."

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