

A world of possibilities with 3D printing

The additive manufacturing industry is expected to grow from US\$3 billion (S\$4 billion) in 2013, to more than US\$21 billion in worldwide revenue by 2020. From making customised hearing aids to bone implants and aerospace parts, the possibilities are endless with 3D printing

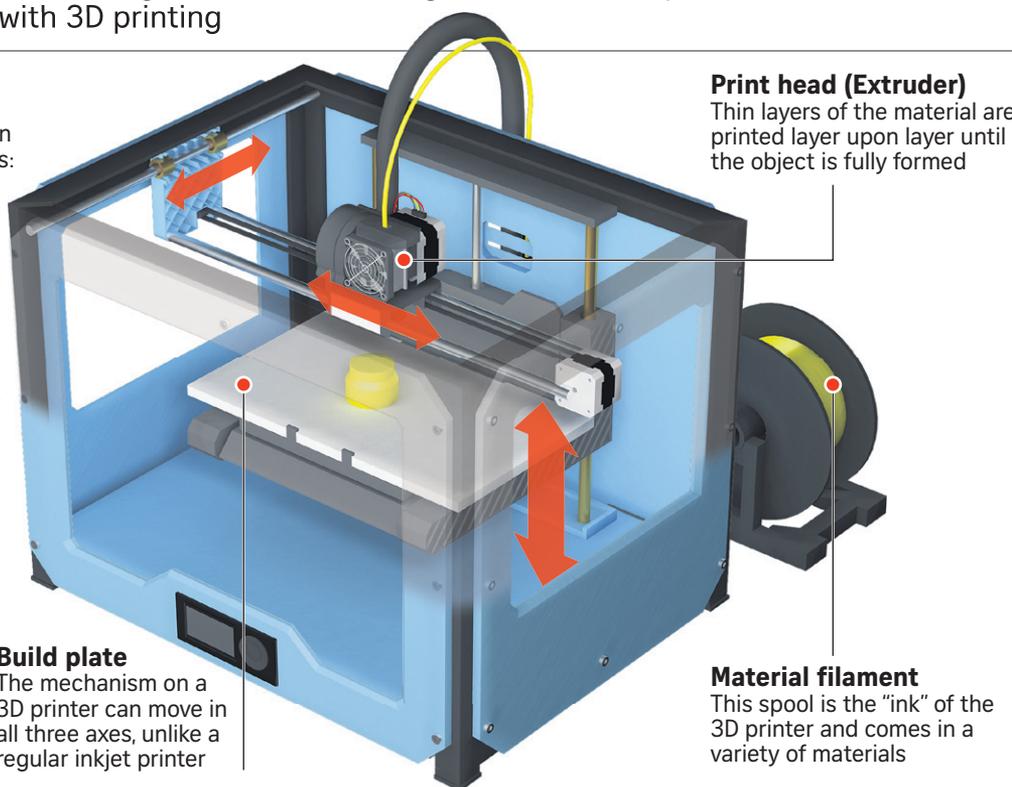
3D PRINTED PILLS

Devised by NUS researchers, customised prescription pills can also be made using 3D printing. We take a look at the process:

■ Template and mould creation ■ Tablet creation



- A template shape is first created using a 3D software on a computer
- The shape is fully customisable, allowing for different drug-release profiles
- The digital object is sent to the 3D printer

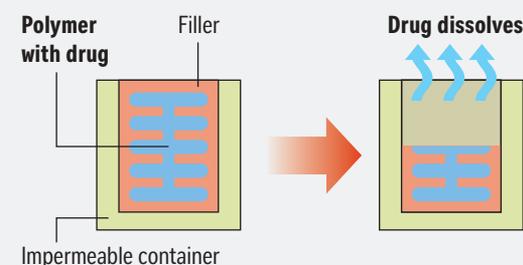


Print head (Extruder)
Thin layers of the material are printed layer upon layer until the object is fully formed

Build plate
The mechanism on a 3D printer can move in all three axes, unlike a regular inkjet printer

Material filament
This spool is the "ink" of the 3D printer and comes in a variety of materials

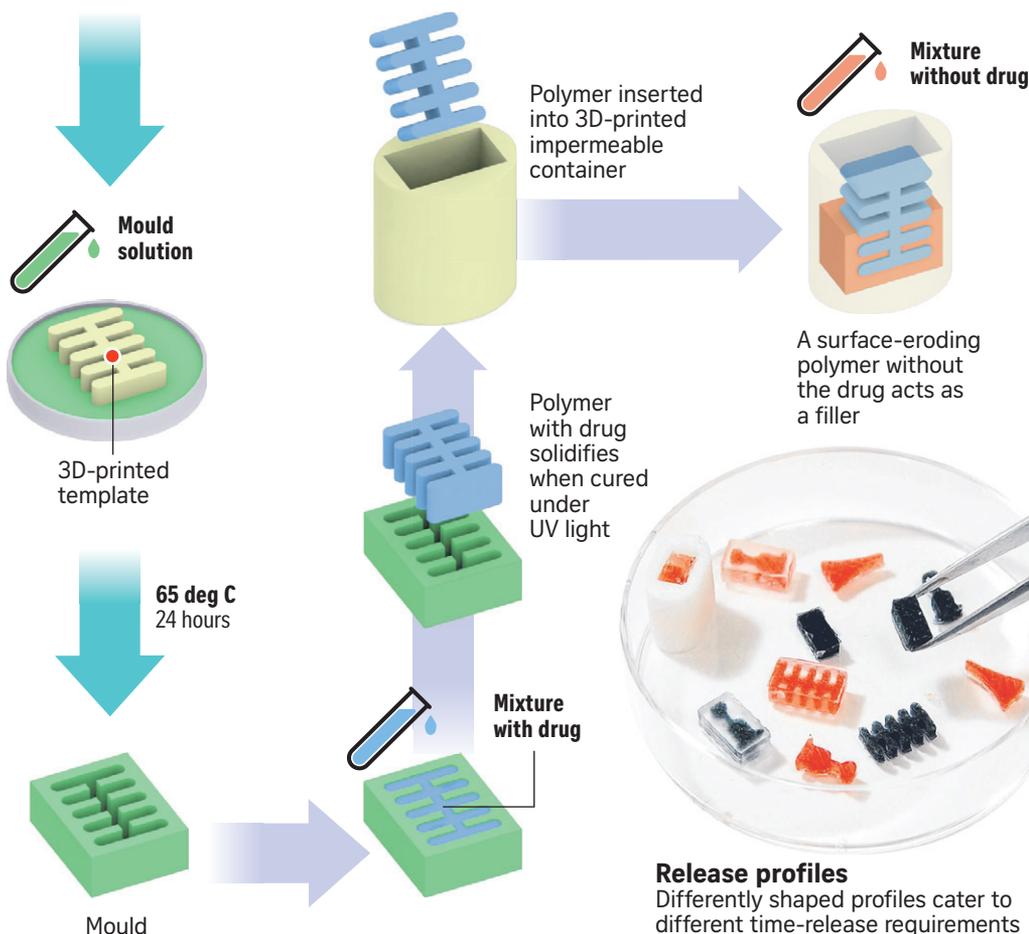
HOW THE PILLS WORK



- The pill is made up of three polymers. A polymer is a type of chemical compound. The first polymer contains the drug and its shape matches the way the drug is to be released, based on a patient's need. The second polymer is a filler.
- The third polymer is a container with an opening at the top. It is not permeable to digestive juices and will dissolve more slowly than the rest of the pill.
- This design means the pill dissolves from the top down, allowing for fine control of dosage and release rate.

BENEFITS

- Low cost
- Technically simple
- Versatile
- On-the-spot creation
- Customised to a patient's needs
- Controlled dosage and release rate
- Multiple drugs can be combined into a single pill
- Utilises commercial 3D printers



Release profiles
Differently shaped profiles cater to different time-release requirements

OTHER BREAKTHROUGHS WITH 3D PRINTING

Bone implant

Developed by NTU and A*Star, the 3D-printed part is made of titanium and tantalum alloys, and can be used for hip or knee implants. The metal alloys help to improve its stress absorption.



Aerospace - GE Aviation's fuel nozzle tip

Now 3D-printed in one piece instead of having to be assembled from 20 different parts, the fuel nozzle tip was approved last year by the United States Federal Aviation Administration. The lighter-weight nozzle tip will last five times longer, and will be used for its Leap jet engines.



Biomedical sensors

NTU scientists are working on 3D-printing electronics on bandages. This could act as a platform for sensors to find out how fast the wound is healing, or even be used for controlled drug release if embedded within a drug patch.

