

3D printing to revolutionise medical devices

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SCIENTIFIC



TECHNO-LOGICAL



HEALTH



ECONOMIC

SUMMARY

3D printing technology is breaking down traditional barriers for manufacturing objects. It turns a design into an object by ‘printing’ layers of materials, building up three-dimensional shapes.

At UCD School of Mechanical and Materials Engineering, Dr Eoin O’Cearbhaill and his team at the UCD Medical Device Design Group are developing new and innovative ways to make cost-effective, efficient and often highly personalised objects to help us to monitor health, deliver life-saving medicines and to support the body as it repairs after injury.

“3D printing lets us quickly tweak designs and make them on the spot so we can test them out.”

3D printing: a game-changer for medical devices

Imagine a needle that can deliver a therapeutic drug without any pain. Or a rigid support for a recovering ankle that fits like a glove. How about a light but strong mesh that can gird blood vessels grafted in to support an ailing heart?

These innovations and many more are in the pipeline, and Dr Eoin O’Cearbhaill’s team at UCD are hastening their arrival thanks to 3D printing, a technology that is disrupting the world of manufacturing.

3D printing uses molten material as its ‘ink’ and builds up layers, following instructions for a pre-programmed design. It is relatively cheap, and the minimal equipment means that small labs, schools and even households can now design and make objects on the spot.

3D printing is already starting to have an impact in medicine, with doctors ‘printing’ out anatomical objects from scans of patients ahead of surgery. And Dr O’Cearbhaill is now using 3D printing to explore the boundaries of medical devices.

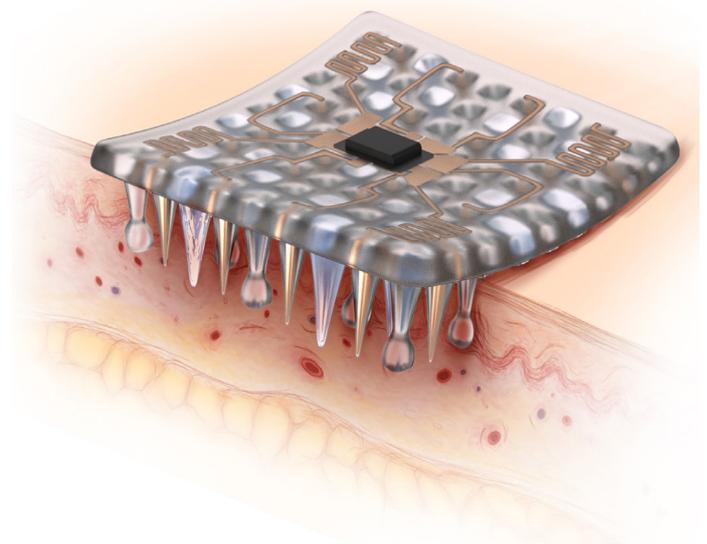
Benefits inside and out

Researchers in the UCD Medical Devices Group are using 3D printing to tackle a range of medical issues with the aim of making solutions that are **more targeted, more personalised and more cost-effective.**

Dr. O’Cearbhaill explains “3D printing lets us quickly tweak designs and make them on the spot so we can test them out.”

The group is working on new ways to make arrays of half-millimetre-high **microneedles** mounted on a patch that can be placed on the skin.

PhD student Ellen Cahill is using 3D printing to develop porous microneedles for **delivering therapeutic drugs into the body**, and her work won first prize at the 2016 UCD MedTech Innovation Sprint Programme.





Meanwhile Dr O’Cearbhaill, UCD engineer Professor Madeleine Lowery, Harvard engineer Professor Conor Walsh and UCD PhD student Kevin Krieger are developing flexible microneedle sensors to **improve monitoring of athletes and people with neuromuscular conditions**, such as Parkinson’s Disease.

It’s not just the tiny devices that can benefit from 3D printing: in summer 2016, biomedical engineering student Ciara Giles Doran worked in the UCD Medical Device Design Group on **3D-printed personalised ankle supports** that can support the lower limb as the patient walks. Group members Dr Shane Keaveney and Colin Keogh, have set up a charity, The Rapid Foundation, to help **provide 3D printed supports such as casts and splints in low-resource settings** and recently ran pilot projects in India and Uganda with UCD Volunteers Overseas.

Moving to the interior of the body, Dr O’Cearbhaill’s group is working with colleagues to 3D print implantable devices for people with coronary artery disease or diabetes, two of the most prevalent chronic diseases in the developed world.

PhD student Oisín Byrne is working with the Science Foundation Ireland Centre for Research in Medical Devices, Cúram, and Boston-based Neograft Technologies Inc. on methods to reliably **3D print structures that can improve coronary bypass grafts**.

Then, as part of the EU Horizon 2020 project DRIVE, the UCD group is seeking to help people with Type 1 diabetes who cannot make enough insulin and would benefit from a transplant of islet cells to generate the hormone.

Dr Fergal Coulter, a postdoctoral researcher in Dr O’Cearbhaill’s group is 3D printing protective ‘shells’ that can act as a protective housing for implanted islet cells, **making transplants more efficient and suitable for even more people with diabetes**.

While many of the technologies are still in development, one of the projects is being commercialised: **a tissue anchorage system for use in surgery** that Dr O’Cearbhaill is now driving with Dr. Nicky Bertollo and Dr. Seamus Morris. The trio have founded a spin-out company Latch Medical. “We have come up with a clever way of getting medical devices to stick to tissue,” says Dr O’Cearbhaill. “We are focusing first on applications in wound closure, where we are hoping to displace existing suturing and stapling technology, but we are very excited about its wider applicability in addressing multiple clinical needs.”

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Krieger), Science Foundation Ireland Centre for Research in Medical Devices, Cúram and Enterprise Ireland. For more details on these projects, please visit <http://drive-project.eu/>, <http://www.therapidfoundation.com> and <http://mdd.ucd.ie/>.

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