

# HEAL IT

Over 5.5 million people have already been treated using 3D printed medical parts.

We are all unique individuals. Our medical needs are unique too.

Today medical specialists are harnessing the power of 3D printing to create custom-made implants.

In future medics might print bespoke treatments made with biological materials, drugs and living human cells.

How can 3D printed medical parts help to heal you?

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# 1. SKELETON SUPPORT



**Wilmington Robotic Exoskeleton (WREX)**

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# 1. SKELETON SUPPORT

‘My team invented a robotic exoskeleton named WREX.

‘Emma has a condition that makes it nearly impossible for her to move her arms. Three years ago, when Emma was two, she gave WREX a try – she lifted her arms up for the first time! The original WREX was too large and heavy, so we 3D printed a smaller version in lightweight plastic. Emma now calls them her “magic arms”.

‘It’s quick and easy to 3D print WREX for young growing children.’

**Tariq Rahman**

Doctor



Image: Tariq Rahman



**Emma wearing WREX**

Image: Nemours/Alfred I duPont Hospital for Children

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## **2. RECONSTRUCT A FACE**



**Maxillofacial implants**

# 2. RECONSTRUCT A FACE

‘I help to rebuild people’s faces after accidents or illness.

‘A motorcycle accident left this patient’s face crushed. Their head was scanned and I worked with surgeons and technicians to design a multi-part implant. Surgeons then used the implant to guide their reconstruction of the patient’s face.

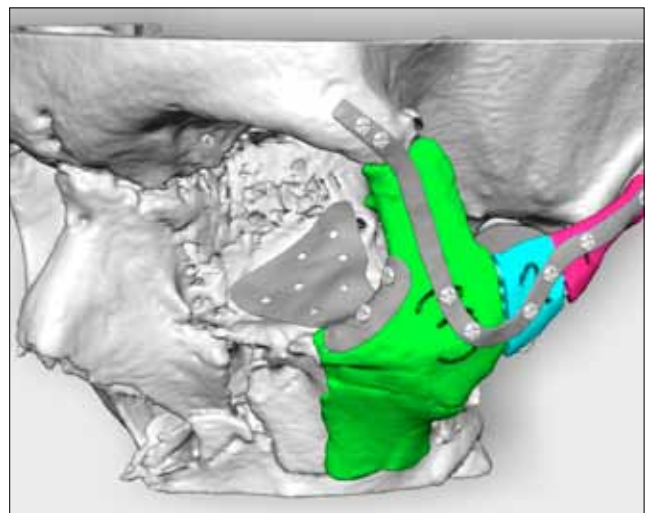
‘3D printing is the only way for me to make such complex implants. And I can print them fast – ideal for urgent trauma cases.’

### **Dominic Eggbeer**

Medical implant supplier



Image: Medical Applications Group at PDR, Cardiff Metropolitan University

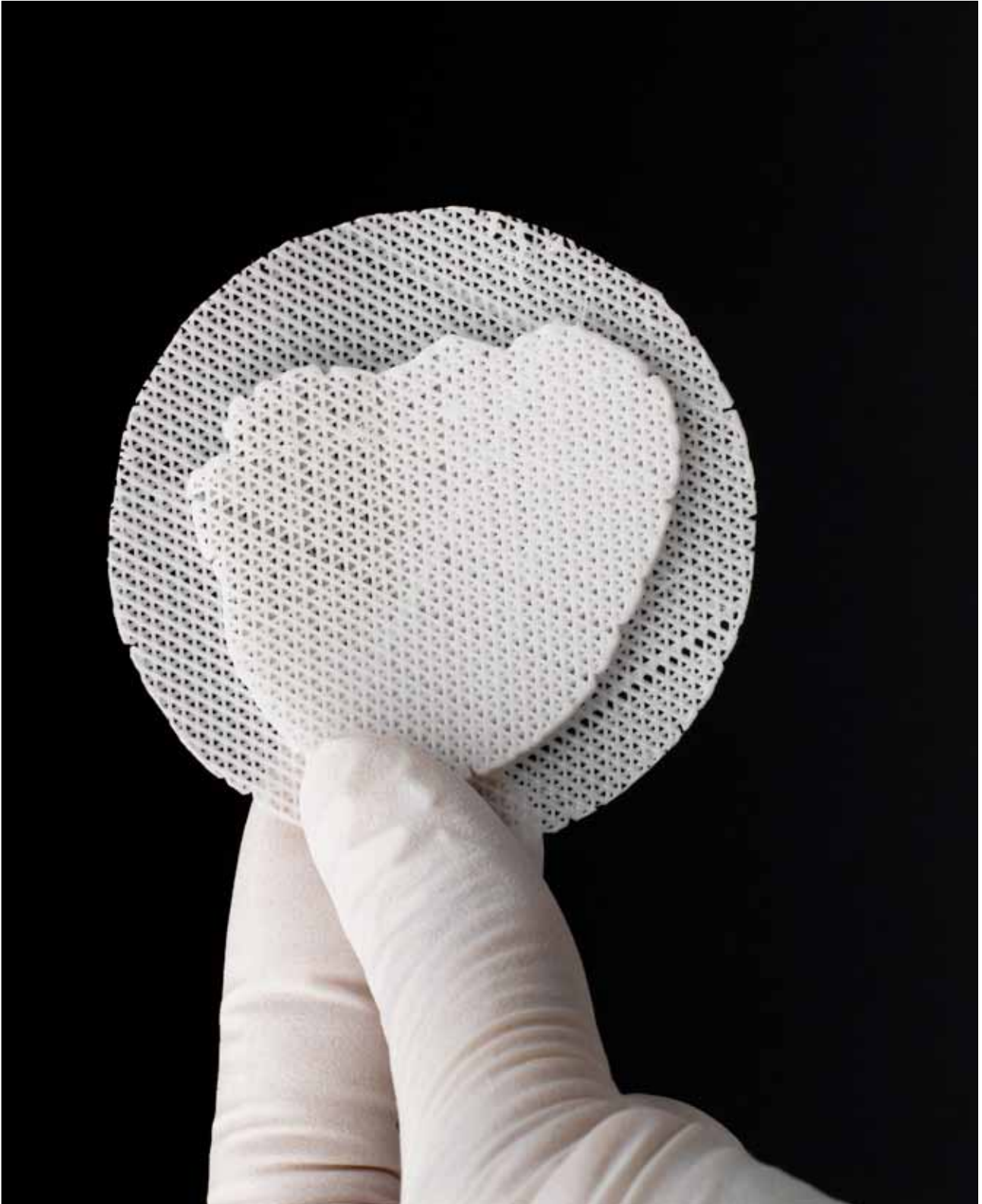


**Computer model of implant parts**

Image: Dominic Eggbeer, Cardiff Metropolitan University

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# 3. SKULL PATCH



**Skull bone scaffolds**

# 3. SKULL PATCH

‘I make “scaffolds” that fit your body shape and size, and they encourage new bone growth.

‘A nine-year-old patient lost a piece of her skull. I scanned her head and designed this scaffold – it’s an exact fit for her missing bone. It is 3D printed in “body-friendly” materials and has a precise network of channels inside.

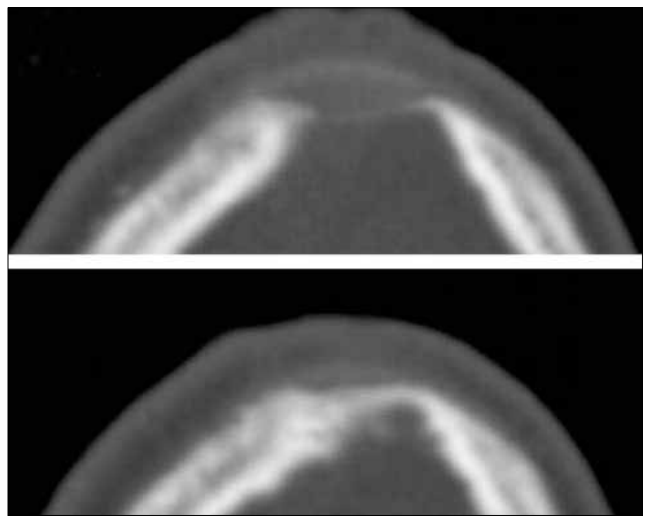
‘The girl’s own bone cells travelled into the scaffold implant and new tissue grew. Within three years the scaffold dissolved. New healthy bone had filled the missing piece of her skull.’

## **Dietmar W Hutmacher**

Medical researcher



Image: Dietmar W Hutmacher, Jan-Thorsten Schantz, Kim Cheung Tan, Swee Hin Teoh, Medical Research Team



## **MRI image of bone regrowing**

Image: Dietmar W Hutmacher, Jan-Thorsten Schantz, Kim Cheung Tan, Swee Hin Teoh, Medical Research Team



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## 4. REPLACEMENT PARTS



Prototype ear, nose and finger scaffolds

## 4. REPLACEMENT PARTS

'I research how to grow new body parts.

'In the future, if you lost an ear, I'd scan your other ear and generate a computer model. I'd print this ear from your cells and "body-friendly" materials. These cells would grow into new tissue inside you.

'In my lab we're working to print ears, noses and also fingers, which are trickier as they need tendons and joints. In the future we want to print more complex things, like organs.'

### **Anthony Atala**

Medical researcher



Image: Wake Forest Institute for Regenerative Medicine



**3D printed nose implanted**

Image: Glenn Green, University of Michigan

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# 5. NEW ORGANS



**Printed blood vessel and bladder**

# 5. NEW ORGANS

'I research how we might 3D print human tissues and organs.

'I 3D printed this prototype bladder and blood vessel and covered them with animal cells that glow under UV light. I research how to print "inks" that contain cells so in the future I can print complex organs.

'The average waiting time for a new liver is 142 days. If we can print organs, patients who need transplants wouldn't have to wait for donors. And if we can print with their own cells their body would not reject it.'

### **John Hunt**

Medical researcher



Image: The UKCTE Institute of Ageing and Chronic Disease, University of Liverpool



**3D printing with 'ink' containing cells**

Image: Wake Forest Institute for Regenerative Medicine

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# 6. BETTER DRUGS



**3D printed drugs**

## 6. BETTER DRUGS

‘If you live with a serious illness you might have to take 20 tablets a day. I aim to make a single tablet tailored to treat all your symptoms.

‘With a 3D printer I can cram active ingredients of different drugs into just one tablet. And I can print each ingredient exactly where I want it. I coat different ingredients with materials that delay the release of each drug, so they will only act when you need them.’

**Clive Roberts**

Nanotech researcher



Image: School of Pharmacy, The University of Nottingham



**How many pills a day?**

Image: Flickr/Feggy Art