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ADVENTURES IN SCIENCE

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3D printers
are producing:
dino bones
action figures
robo arms
human skin
cool guitars
& much,
much more

making the
FUTURE



COMING S

TO A HOSPITAL NEAR YOU!

3D printing lands a leading role in medicine

by Kristina Lyn Heitkamp

Medical three-dimensional printing is about to blow your mind! But don't worry. In the future you might be able to print a replacement.

Medical 3D printing is similar to regular 2D printing. But instead of using ink on a piece of paper, 3D printing uses plastic, metals, and even human cells as ink. Layer by layer, the three-dimensional object is created, whether it's a replica of a dog's skull or a human ear.



OOON

Bioprinting and DIY hands are two examples of medical 3D printing. Wave to Luke, who has helped teach others how to make their own prosthetic hands!





Scientists, engineers, and enthusiasts have been experimenting with medical 3D printing in a variety of ways, from producing educational models for students and doctors to practice on and study to printing parts of a prosthetic hand that can be assembled on your kitchen table.

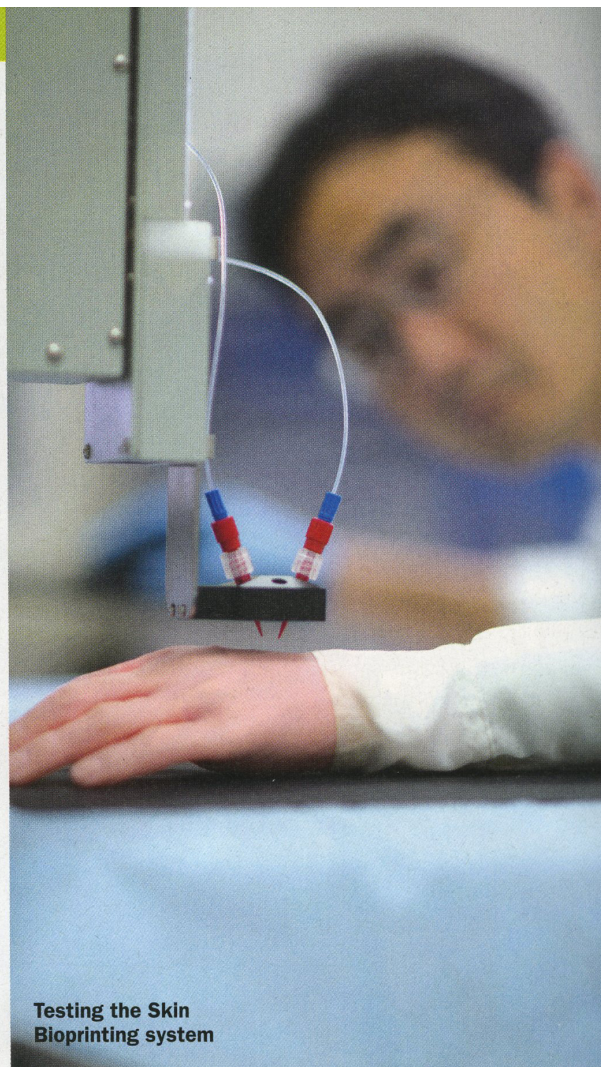
Prosthetics can come with a hefty ticket price, but with 3D printing, materials are inexpensive and the prosthetic easily customized. With the low cost, a new hand can be made when needed—say, if a finger gets busted from playing basketball or after a sudden growth spurt.

Introducing Talon

Nineteen-year-old Peregrine Hawthorn has been using a 3D-printed prosthetic hand for more than a year. Born without any fingers on his left hand, he says he can do most things pretty well—but for some things you really need all ten fingers. Hawthorn heard about 3D printing years ago but had no idea how useful it could be. “I just thought it was this neat, sciencey thing,” he said.

Together with his father, Hawthorn tinkered around with the design and function of a 3D-printed prosthetic. He knew he wanted a hand that could be knocked around, especially during heavy yard work. \$50 in supplies later, the Talon was created. “Plus the Talon looks really cool, and that’s always important,” he said.

There are still some things Hawthorn can’t do with the Talon, like lift more than ten pounds. Plus wearing the hand can be tiring and strain his arm. But there is always room for improvement. Hawthorn is part of the group e-NABLE: a global network of engineers, medical professionals, students, and



Testing the Skin Bioprinting system



parents who collaborate and volunteer to design and make 3D-printed prosthetics.

Blockbuster Technology

Slipping on a prosthetic hand or studying a printed human jawbone is just scratching the surface of possibilities with medical 3D printing. Wake Forest Institute for Regenerative Medicine located in Winston-Salem, North Carolina, began experimenting with the technology. They have bioprinted a three-dimensional model of a kidney.

Bioprinting is similar to regular 3D printing, but instead of plastic it uses live human cells to build a functional living organ. The patient's own cells are used, so the printed organ is compatible and chance of rejection is slim to none. Then the cells are bioprinted in a very specific order, built from the ground up or with the assistance of a 3D-printed scaffold or mold in the shape of the organ.

After printing, the organ is placed in an incubator, where cells have time to mesh and grow together. But before it's ready for the operating table, the bioprinted organ has to do more than just look the part. Scientists perform a series of tests to make sure it's up for the job.

Behind the Scenes

Dr. Aleksander Skardal, a Wake Forest Institute scientist and professor, has been working with bioprinting for more than eight years. He says it's been wildly interesting building organs from scratch. His favorite bioprinting project is the Body-on-a-Chip. "We are bioprinting small, even microscopic, versions of different organs. Then we connect them all together on a microchip, which lets us model the human body on a tiny microchip," he said. They use the Body-on-a-Chip to test the effectiveness and safety of new medicines.

Another exciting development is the Skin Bioprinting project. "We're printing skin cells onto wounds. Researchers on our team have developed a machine that can bioprint new cells directly onto a person's hurt part of the body. These cells then turn into new skin over time," Skardal said. He hopes this technology will eventually be used in hospitals.



Stay Tuned . . .

Libraries across the United States are beginning to offer 3D printing. You can even buy a small 3D printer at the local hardware store. With easier access, the question of what's next tickles the minds of many. The opportunity to print workable parts, whether plastic or living, could produce a future of robohands and lab-grown ears. It could mean no more organ donor waiting lists. But if you could bioprint a human heart, what's next? A brain? Think about it.

Kristina Lyn Heitkamp is a Montana-based writer, researcher, and environmental journalist. She enjoys 3D movies, fashion, and foods. But Heitkamp is most excited about possibly getting a 3D-printed crown for her sweet tooth.