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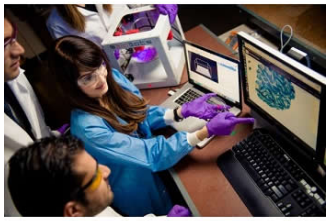
Is 3D Bioprinting Finally Here?



Researchers at Michigan Technological University have acquired a new 3D bioprinter and are hoping to use it to make synthesised nerve tissue. The tissue-printing machine looks like a toaster oven and is small enough to fit on top of an old-fashioned school desk, but there is really nothing old-fashioned about it. It looks more like a sci-fi future in the flesh and could have very real and very useful medical applications.

Tolou Shokuhfar, an assistant professor of mechanical engineering and biomedical engineering at Michigan Tech believes that the key is to develop the right bioink. He is confident that the nanotechnology-inspired material could help regenerate damaged nerves for patients with spinal cord injuries.

Shokuhfar collaborated with Reza Shahbazian-Yassar, the Richard and Elizabeth Henes Associate Professor in the Department of Mechanical Engineering-Engineering Mechanics at Michigan Tech. It was Shahbazian-Yassar's interdisciplinary background on cellulose nanocrystals as biomaterials that helped inspire the lab's new 3D printing research. Shokuhfar explains that nerve regeneration is a difficult biomedical engineering conundrum and although efforts have been made to print full organs, there has been very little success.

"We can pursue nerve regeneration research with a simpler printer set-up," says Shayan Shafiee, a PhD student working with Shokuhfar. The small grey box that uses a large syringe holding a red jelly-like fluid may be the key to printing tissue.

Science fiction has long dreamed of constructing flesh. The latest Avengers movie features a complete 3-D printed superhero called The Vision. However, reality still has a long way to go. While 3D bioprinting is finally here, it is currently focusing on building up one tissue at a time.

Shafiee points out that the idea is based on fractal geometry. He demonstrates a red gummy candy, about the size of a half-dollar with small crenulations and holes. These are similar to the human vertebrae and the idea is to let a nerve pass through these holes. Shafiee explains that the first step is to synthesise a biocompatible polymer that is syrupy—but not too thick—and that can be printed. The key is to create the material to print with.

Shokuhfar has worked with graphene in her biomaterials research and she believes that graphene is a wonder material which has very good electrical conductivity properties. Since nerve function is all about electrical pulses, this could be a viable solution and graphene could be used for nerve cell printing. There is a possibility that a biocompatible, graphene-bound polymer may melt, mush or flat out fail under the pressure of printing but Shafiee and Shokuhfar are confident these issues can be overcome.

"It's like other 3D printers, you need a design to work from," Shafiee says, adding that he will tweak and hone the methodology for printing nerve cells throughout his dissertation work. He is also hopeful that the material will have use beyond nerve regeneration.

Source: Michigan Technological University

Image Credit: Sarah Bird, Michigan Technological University

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