3D Bioprinting

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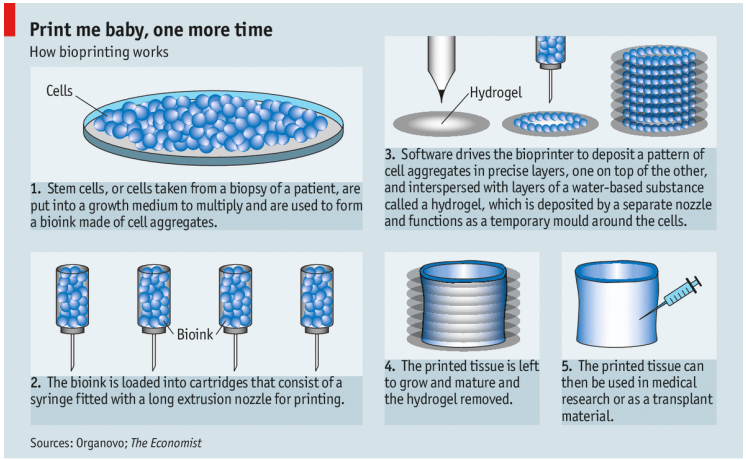
Abstract

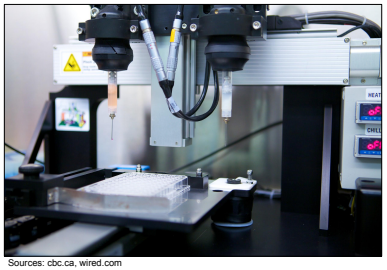
3D bioprinting is the relatively new process of recreating living cells and tissues using a 3D printer. Although the use of bioprinting is still a long way from being hugely practical, the perfection of recreating these tissues would greatly advance the medical field in tissue engineering. Using cells from the patient so their body would not reject the printed bioprint, replacement tissue could be crafted and replace the defective cells in the patient. This has potential to result as a future substitute or even an improvement to original body materials. As of right, now surgeons and scientists have been able to implant a variety of engineered flat, tubular and hollow tissues into patients, including skin, cartilage and muscle. With more time and research these scientists hope to be able to print functioning human organs within the foreseeable future.



How it Works

Bioprinting is the process where cells acquired from a second source are loaded into a 3D bio printer which contains two heads. The first head distributes the cells between layers of hydrogel produced by the second head. This hydrogel is a water-based bio paper that supports and connects the cells. These layers form tissues which then result into organs. Eventually, the hydrogel dissolves leaving only the cells in the final product. Despite the complexity of organs, only relevant cells are necessary to print rather than every detail of the organ. Then, these relevant cells naturally reproduce and migrate until a functioning organ is constructed.

Source: "ExplainingTheFuture.com : Bioprinting." *ExplainingTheFuture.com : Bioprinting*. Web. 30 Mar. 2015. <http://www.explainingthefuture.com/bioprinting.html



Sources: cbc.ca, wired.com

Limitations

Although bioprinting simple structures has been proven successful in many studies, the construction of more complex structures remains a challenge. One limitation of bioprinting is the lack of mechanical strength and integrity, which is a result of the properties of hydrogels used in the process. The fabrication resolution of bioprinters also poses a challenge when constructing complex structures with multiple types of cells that require resolutions of miniscule scales. Additionally, vascularization of engineered tissue is an issue, as tissues that require an adequate supply of nutrients and oxygen must include the induced development of blood vessels. Lastly, the speed of the bioprinting process places limitations on its applicability. By increasing printing speeds, cell damage is induced; therefore improving the speed of bioprinting is a challenge in itself.

Source: Seol YJ, Kang H-W, Lee SJ, Atala A, Yoo JJ. Bioprinting technology and its applications. Eur J Cardiothorac Surg 2014; 46 (3): 342–8.

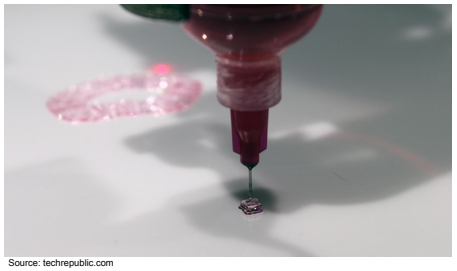
Conclusion

If bioprinting is researched and followed through to its full extent, there would be potential to change the entire world. When artificial organs can be produced and transplanted, the millions of people on varied transplant lists would not have to wait for the perfect match to show up, but rather wait for it to be produced. This will greatly reduce the wait times, saving all of the patients who are in need of urgent transplants. Bioprinting will also be a safer than the current organ transplants because each organ will be custom made for each patient. Since there is still a great deal of research needed to reach this point, we can only hope that we are able to see bioprinting at its full potential within our lifetime.

Future Goals

Bioprinting is at its very infancy as of 2015 with future aspirations that could change the world. Bioprinting hopes to further its now limited field into organ production. By layering cells together bioprinting can make organic tissues and hopefully organs that would eliminate the need for organ donors. Furthermore the researchers hope to take cells from patients and use them as a template for the organ production. Doctors could take the cells of their patients and use them to produce the hearts and greatly reduce the fear of the body rejecting the newly made heart.

Source: "Emerging Field Of Organ Printing." *Impact Lab*. 9 Nov. 2008. Web. 29 Mar. 2015.



Source: techrepublic.com