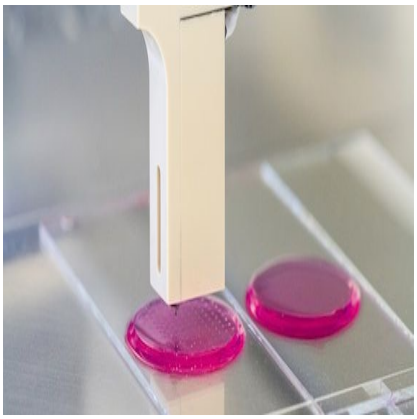
HealthManagement.org
Promoting Management and Leadership

How To Print Your Own Tissue Types



It sounds like a futuristic dream, yet it has been researched for a number of years already: simply printing out tissue and organs.

Scientists have been able to further refine the current technology and are now in a position to produce various tissue types.
A statement released by the German Organ Transplantation Foundation (DSO) shows an 18% decline in the number of organ donors for the first six months of 2013. This is a significant drop compared to the same period in the year before and could be connected to recent transplant scandals.

The fact of an ageing population coupled with advances in the field of transplantation lead to the expectation that demand for organs will continue to rise globally. Cells, tissue and organs affected by a number of critical diseases can be replaced and treated successfully in today's modern medicine and together with governments and the industry, research institutes have concentrated on improving artificial production methods and procedures for tissue creation.

In the aim to fill the supply gap, bio-ink made from living cells may become the answer and connect the production of artificial tissue with a rather improbable technology: the inkjet office printer.

Scientists of the Fraunhofer Institute for Interfacial Engineering and Biotechnology (IGB) in Stuttgart have successfully developed suitable bio-inks compatible with this printing technology. Consisting of components from the natural tissue matrix and living cells, the transparent liquid substance is derived from gelatin, which in turn is based on collagen, the central element of native tissue.

By chemically altering the gelatin's gelling behaviour researchers have adapted the biological molecules for printing, resulting in the bio-inks remaining fluid during the printing process. Once they are irradiated with UV light, they crosslink and cure to form hydrogels. Similar to native tissue, these polymers have a vast water content, however they remain stable in aqueous environments and the physiological temperature of 37°C.
The chemical modification of these biological molecules can be controlled, resulting in gels of varying strength and swelling characteristics, hence the properties of natural tissue from solid cartilage to soft adipose tissue can be imitated.

The tissue printers in the Stuttgart labs are very similar to the known office printers with identically constructed ink reservoirs and jets. Differences lie in the smaller tank sizes, fewer jets and the installation of a heater on the ink container, which allows for the correct setting of the bio-ink temperature.

Dr. Kirsten Borchers decribes the IGB's approach as an effort to concentrate on the 'natural' variant, with the aim of staying extremely close to the original matter. Acknowledging the huge potential for synthetic hydrogels, Dr. Borchers insists on the need to learn about the interactions between the artificial substances and cells or natural tissue in order to promote the self-organizing behavior of the printed cells towards forming a functional tissue model.
In future, Dr. Borchers would like to see the number of printers increase in cooperation with the industry and other Fraunhofer Institutes, so as to simultaneously print using various inks with different cells and matrices. Complex structure and different tissue type replication would become more achievable.

The production of vascularised tissue, with its own system of blood vessels through which the tissue can be provided with nutrients, remains the biggest challenge. It has been taken on by IGB together with other partners under Project ArtVasc 3D, a European Union supported scheme that aims at generating fine blood vessels form synthetic materials. This technology platform would allow for the pioneering creation of artificial skin with its subcutaneous adipose tissue.

"This step is very important for printing tissue or entire organs in the future. Only once we are successful in producing tissue that can be nourished through a system of blood vessels can printing larger tissue structures become feasible," Borchers concludes.

Source: AlphaGalileo

24 October 2013

Published on : Thu, 31 Oct 2013