Organ Bioprinting
The Next Generation Revolution in Medical Science
Mahnoor Patel
Department of Molecular Biology and Genetic Engineering, School of Bioengineering and Biosciences, Lovely Professional University, Phagwara-144411, Punjab, India.
Email: patelmahnoor786@gmail.com

Abstract
The idea about lab grown organs is possibly the end of drug testing on the experimental animals or the human participants. Solution of organ shortage and the desperate ending state of organ donations worldwide can be solved. 3D Bioprinting is a revolutionary mind blowing medical technology emerged in the last few years. It involves the creation of living tissues, like bones, blood vessels, heart or skin with the help of additive manufacturing which is also known as 3D Bioprinting. Unlike other printing technology for the objects, Bioprinting not only needs living cells, they also need environment for nurturing to stay them alive, like food, water and oxygen. Nowadays, these kinds of conditions are provided by microgel, such as gelatin enriched with proteins, vitamins and many other compounds for life sustaining. Furthermore, for creating the fostering conditions and fastest efficient cell growth, scientist plant cells around 3D scaffolds which made of biodegradable polymers or collagen so that organ can able to grow in fully functional living tissue. Bioprinting is time-consuming and difficult also, but by doing proper research all problems can be solved for making organs available in transplantation process. Mass production of the organs for medical purpose likely to solve in the coming next decade. Also it is too much difficult to print the complex organs. Also if the technology available more easily, tissue engineering will become more feasible than entire organ printing. Bionic ear, synthetic skin, bladder or cornea might be the first tissues to be bio printed or completely grown in the lab on demand. These tissues having small numbers of cell types, it can be the first one for fully grown bio printed organs. After this success, bio printing of more complex organs can be done in future.

3D Bioprinter & Bioprinted Heart

3D Bioprinting Technology
Bioprinting is an additive manufacturing process where biomaterials like cells and growth factors are combined to create tissue-like structures that imitate natural tissues. The technology uses a material known as bioink to create these structures in a layer-by-layer manner. The technique is widely applicable to the fields of medicine and bioengineering. Recently, the technology has even made advancements in the production of cartilage tissue for use in reconstruction and regeneration. A digital model becomes a physical 3D object layer-by-layer. In this instance, however, a living cell suspension is utilized instead of a thermoplastic or a resin. In order to optimize cell viability and achieve a printing resolution adequate for a correct cell-matrix structure, it’s necessary to maintain sterile printing conditions. This ensures accuracy in complex tissues, requisite cell-to-cell distances, and correct output.

3D Bioprinting Process
The process involves preparation, printing, maturation and application.
Pre-bioprinting: Involves creating the digital model that the printer will produce. The technologies used are computed tomography (CT) and magnetic resonance imaging (MRI) scans.
Bioprinting: It is actual printing process, where bioink is placed in a printer cartridge and deposition takes place based on the digital model.
Post-bioprinting: It is the mechanical and chemical simulation of printed parts so as to create stable structures for the biological material.

Applications
Artificial Organs: These are one of the greatest drivers of the technology due to the high risk of vital organ failure. Availability of 3D printed organs helps to solve organ-related issues faster and quicker, which is important to patients, their families and healthcare systems.
Pharmaceutical Testing: Tissue development for drug testing is more cost-effective and ethical option. It also helps in identifying side effects of drugs and allows recommended drugs to be administered to humans with validated safe dosages.
Cosmetic Surgery: Particularly plastic surgery and skin grafting, also benefits from the technology. In this application, bioprinted skin tissue could be commercialized. Some 3D printed tissues are already being bioprinted for therapeutic research purposes.
Bone Tissue Regeneration: It is for prosthetics and dental application. One day Scientist will successfully restore function to damaged, complex organs, either through cell therapies or perhaps by inserting slice of functioning engineered tissue into the damaged organ.