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ORGAN SHORTAGE: WILL TISSUE ENGINEERING ELIMINATE THE SHORTAGE?

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TISSUE ENGINEERING: SHOULD THERE BE A MAJOR FOCUS ON ARTIFICIAL ORGANS?

The need for organs is growing exponentially, and the shortages in organs has become an engineering problem. There are people all across the world who go to a hospital and are told that they need an organ transplant as soon as possible because their liver is failing, or they have untreatable cancer, and the list of unfortunate news one could hear is endless. Sadly, the supply for organs is very limited. Limited by the fact that people are living longer lives, decreasing the availability for major organs, and limited by the factor of organ compatibility. These limits leave many people to suffer which is why tissue engineers and many other scientists are looking for the best technology to solve this problem. Scientists have started to hone in on the use of natural polymers to approach this process. Specifically, they have been researching technology in the extracellular matrix (EMC) and porous polymers. My eyes were opened to this EMC research two years ago when I was at a Summer Science Nation Camp at Carlow University. A researcher at the McGowan Institute for Regenerative Medicine at the University of Pittsburgh (McGowan Institute) had come to talk to the group. During this talk, I was very motivated to do more research into the new technology that was emerging in the tissue engineering field.

Going into my senior year in high school, I decided to write my senior paper on tissue engineering organs. This research kept leading me to research tissue engineering to a deeper extent. I choose to focus on the technology in regenerative medicine with tissue engineering to further my knowledge of the technology being used. I also chose this area of discussion to keep up to date on the research being done in this field. According to doctors at the University of Erlangen Medical Center, “Tissue Engineering in the context of Regenerative Medicine has been hailed for many years as one of the most important topics in medicine in the twenty-first century” [1]. Within all of the articles I have read, the scientists and engineers who have written articles about their work are engrossed with the problem at hand. There are many obstacles that they face, but they are dedicated to finding a solution to help ease the world’s organ shortage. I am in agreeance with these researchers. I believe there is great value in having this knowledge and technology at our fingertips will benefit mankind. Not only is it a giant leap for medical treatment, it would also improve the lives of the patients. For example, Andemarian Beyene was diagnosed with late-stage tracheal cancer, but the research in tissue engineering saved his life. I believe research into tissue engineering will improve the lives of others and make huge strides in medical treatment.

PRODUCING AN ARTIFICIAL ORGAN: HOW DOES IT WORK?

Strides in medicine have already allowed people to live longer lives than ever. Now doctors, scientists, and engineers are turning their research to regenerative medicine with a focus on tissue engineering. Research into tissue engineering shows that it can provide a base for many medical accomplishments. Though much of the research is still beyond the technology, the premise is still there and the technology is quickly catching up to the research. Research specifically into EMC has made great advancements in the last five years. EMC is the non-cellular component that is the building blocks of all tissues and organs. EMC functions as a relay station, and it sends messages from many sources to a cell telling the cell what it will become [2]. EMC is obtained by decellularizing tissues and organs. Each process is slightly different due to the makeup of each object. The density, thickness, cellularity, and a few other factors determine which chemical agents one uses to remove the cells without destroying the EMC. The tissue or organ will go through a chain of soaking the object in many solutions to accomplish removing the cells [3]. After the decellularizing process, one is left with a scaffold of what it previously was. These are often called ghost organs.
research is still new, risky, and costly if one chooses to have an engineered organ transplant done.

**TRACHEAL IMPLANT: THE FIRST SUCCESSFUL ARTIFICIAL ORGAN TRANSPLANT**

Though results of receiving an engineered organ has not officially been been through clinical tests, there are scientists around the world inventing new organs in many different ways. There are also patients around the world desperate to try anything to survive. Andemarian Beyene happened to be one of those patients. After being diagnosed with late-stage tracheal cancer in 2008 and unsuccessfully going through all of the typical treatments, Beyene was left with little time to wait for a tracheal donor. He jumped at the chance to receive a tracheal transplant that was tissue engineered. Scientist Alexander Seifalian used a scaffold of porous polymers coated with the right growth factors to design a windpipe. This windpipe was successfully made, and nurtured with Beyene’s bone marrow in ten days. In 2011, Beyene became the first patient to successfully have an artificial trachea implanted, and five years later he is still healthy [7].

**ARTIFICIAL ORGANS: ARE THEY REALLY WORTH THE RESEARCH?**

The wait for an organ donor is a long and stressful ordeal. Though tomorrow is not promised, a patient waiting for an organ transplant lives with the fact they may not wake up the next day because of their failing organ. Beyene jumped at the chance to receive an artificial organ so he could have a more certain tomorrow than if he had not jumped at the chance. The list of people waiting for an organ donor is devastatingly longer than the number of organs the world has to provide. Engineers love to solve problems, and this is a major problem that the medical world faces. Research in regenerative medicines and tissue engineering provide access to developing new technology in order to solve the problem at hand. Using an EMC scaffold and polymers, one can design a readily full functioning organ. When a patient’s stem cells or bone marrow are added to this structure, it produces an artificial organ specifically for that person. Having the access to organs designed directly for a patient practically eliminates the need for organ donors and the wait for an organ. This problem is important to engineers because solving the problem would improve the lives of many people. I want to be an engineer involved in developing this kind of technology because it is high demand. There are many people in this world that are in need of an organ transplant, and since previous medicines have helped people live longer there are less organs to go around. It only seems fit that I participate in the advancement of medical treatments to fulfill the huge gap in the demand for organs.
Sources


ADDITIONAL SOURCES


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