

Envision a treatment that frees a child from the daily insulin injections of diabetes, or aids a young man or a grandmother destabilized by heart failure to live longer and recoup their independence. Picture damaged organs re-growing and wounds healing without scars. Is it possible to have a ground-breaking technology that can utterly change the concept of organ transplantation in Egypt for good? These therapies may sound like science fiction, but these examples as well as many others have become a reality now thanks to regenerative medicine.

If we to examine the organ transplant system in Egypt we will find that it is a very convoluted process. According to the new law, organ donations and transplants are limited to family members and are prohibited between people of different religions or nationalities, thus not allowing trading human organs¹. Furthermore, ferocious penalties are enforced on doctors or hospitals that perform illegal transplants². The new law might work however, it still has a long way to go as there are major ethical questions with regards to how far should hospitals and medical institutions go in order to get organ donors. What gives them the right to take advantage of other unfortunate citizens who are uneducated and lured by any source of income that would allow them to barely get by even by giving up their own organs? Without any regulation, Egypt has suffered from the problem of organ trafficking for years. Many have been manipulated into selling their organs with little knowledge of the consequences due to poverty and desperation³. Hamdi El Sayed, chairman of the Doctors Syndicate and head of the PA's Health Committee, points out that "We are one of just four countries that have registered increasing rates of illegal organ transplants" ⁴. Additionally, 20 human rights organizations have filed suits against 20 hospitals for organ trafficking⁵.

Another perspective of the new law would be that, according to El Sayed, "The law is being held up because of religious leaders who do not agree with all types of organ donations especially when it comes to cases of brain death. For them, the whole body has to have died; all organs must have come to a standstill". El Sayed elaborated by saying, that once the debate about brain death is cleared, the infinite demand for organ donations would be met. He also stated that their future vision would be towards more organ donation centers and a culture that comprehends organ transplants better⁶. One must say that the previously mentioned problems could be contained to a great extent if certain technological solutions were to be implemented.

Despite the current system one must not lose hope, as there are many medical breakthroughs that are developed every day to extend the average life expectancy of humans, thus providing them with better and healthier lives. One of them concerning the organ transplantation is a new technology called regenerative medicine. It has been studied by several American institutions such as Wake Forest University Baptist, University of Pittsburgh Medical Center, and University of Minnesota, who are now international leaders in translating scientific discovery into clinical therapies.

Regenerative medicine is a "new way of treating injuries and diseases that uses specially-grown tissues and cells, laboratory-made compounds, and artificial organs. Combinations of these approaches can

¹ ElKady

² Leila

³ ElKady

⁴ Leila

⁵ Awad

⁶ ElKady

amplify our natural healing process in the places it is needed most, or take over the function of a permanently damaged organ". Experts in biology, chemistry, computer science, engineering, genetics, medicine, robotics, and other fields are working together on this new field to solve the most demanding medical problems faced by humanity⁷. According to Wake Forest University Baptist Medical Center, more than 150 scientists are working together at the institute in the field of regenerative medicine⁸.

The process of growing each patient's organ starts with a biopsy to get samples of the specific organ cells. These cells are in the laboratory until there are enough cells to place onto a specially constructed ecological mold, or scaffold, shaped like the designated organ. The cells continue to grow, and seven or eight weeks after the biopsy, the engineered organs are then sutured to the patient's body during surgery. The scaffold was designed to dissolve as the organ tissue is built in with the body, creating a normal functioning organ.

The first human recipients of laboratory-grown organs were carried out by Anthony Atala, M.D., director of the Institute for Regenerative Medicine at Wake Forest University School of Medicine. This institute has 60,000 square feet of research space, which makes it the largest freestanding facility in the world devoted to regenerative medicine⁹. Atala states "This is one small step in our ability to go forward in replacing damaged tissues and organs" who is currently in the process of growing 20 different tissues and organs, including blood vessels and hearts, in the laboratory¹⁰.

The engineered organs are grown from the patients' own cells, therefore according to the studies conducted there is no risk of rejection. Atala's report involves children who were treated at Boston Children's Hospital when Atala was director of the Tissue Engineering and Cellular Therapeutics at Harvard Medical School. The study already implemented involved patients from 4 to 19 years old who had poor bladder function because of a congenital birth defect and could possibly lead to kidney damage. They had urinary leakage, as frequently as every 30 minutes. The surgery's main goal was to reduce pressures inside the bladder to preserve the kidneys¹¹. Since 1990, Atala had been striving to grow bladders from patients' own cells and he succeeded in implanting the first organ in a patient in 1999. His up to date report tells us about the long-term results with the seven children who had the surgery as he stated that, "We wanted to go slowly and carefully and make sure we did it the right way"¹². Currently, more than 150 scientists are working together at the Wake Forest institute in the field of regenerative medicine where scientists come from 23 different countries.

This new technology will have astounding effects on Egypt as individuals, and as a society if implemented. As individuals they would have healthier and longer lives with no need for chronic organ diseases or disconcerting medications that last for decades. According to Dr. Sherif Hakky, General Surgeon at Kasr El-Aini Hospital, 43% of the population is infected with Hepatitis B and C that can eventually result in the patient's death¹³. Therefore, urgent treatment is needed in order to prevent liver failure that results from Hepatitis. We will find that these diseases are more prevalent in low hygienic

⁷ McGowan Institute for Regenerative Medicine

⁸ "Wake Forest Institute for Regenerative Medicine"

⁹ Winston-Salem

¹⁰ Winston-Salem

¹¹ Winston-Salem

¹² Winston-Salem

¹³ Douara

areas and that from 1990 to 2004 16.7 % of the population were below the national poverty line¹⁴, therefore most likely that a great number of these patients cannot afford to get treatment abroad. It leaves them with no option but to rely on costly government treatment plans that can take up to 20 years¹⁵.

Egyptians deserve to have high quality health care. Picture a situation where we have an Egyptian man seeking treatment from kidney failure for example, where he has three options. The first one is to undergo dialysis, 2-3 times a week where such a painful process would last for the rest of his life. The second option is to get an organ transplant, where in most cases it is hard to find the needed matching organ, and the patient has to wait for a long time. The third option is to have his/her kidney regenerated, that could take up to just a couple of weeks, while enjoying his/her own cells, not to mention that this patient doesn't have to take anti-rejection medicine. For example, recipients of heart transplants must take immune-system-compromising medication for the rest of their lives to stop their bodies from rejecting the new organ. However, according to research implemented in the University of Minnesota, since the replacement heart would be made up of the recipient's own cells and the body replaces the scaffold with its own cells, therefore, a recipient of a bio artificial heart could possibly survive without anti-rejection medicine¹⁶.

As a society, the Egyptian government can use this technology to create more stability, as health care often affects other aspects such as politics and economics. Political in the sense that regenerative medicine would not be a subject to religious taboos. For example, the fact that there are no cadavers involved in the process of regenerative medicine won't leave a chance for debates, especially that patients will use their own cells. Furthermore, there would be no need for unethical conduct or corruption as we now see in organ trafficking, and it's a much safer technology to use. Regenerative medicine if implemented will provide us with more organized legal practices, leading to political stability.

Economically speaking, let's examine the annual cost spent on health care by the Egyptian government. In 2007, the government spent 2 milliards and 30 million Egyptian pounds on 1 million and 602 thousand patients, as opposed to 1 milliard and 745 million Egyptian pounds spent on 1 million and 420 thousand patients in 2006. The number of patients receiving treatment from the government has increased by 12.8% from 2006 to 2007¹⁷. If the government invests in this new technology they might be able to decrease the overall costs of healthcare, because many diseases that have do with organ damage could be cured by regenerative medicine.

In that sense, we have to compare between short term vs. long term costs. When the government spends money on citizens for the usual medical treatment in the cases of renal or hepatic failure or even heart problems, they might live or they might not. So in that case, a lot of money is spent with no guarantee of a positive outcome. We are not suggesting that the government should be apathetic when it comes to healthcare. On the contrary it is just that regenerative medicine promises more effective results, which is perhaps where the government should focus their efforts. If the government invests in regenerative medicine, and sets up the needed facilities, then at least expenditure in that case will be justified. Spending on such a technology might be very costly in the short run, but it will pay off in the long run, according to the experiments done by the reputable entities previously mentioned. Furthermore, just as any new technology, its introduction costs are very high but then when it becomes very accessible, its costs are lowered. So in that case the government spends health care money on people who will actually

¹⁴ 2007/2008 Human Development Report

¹⁵ Douara

¹⁶ "Center for Cardiovascular Repair"

¹⁷ Gamal El Deen

live longer (at least longer than the current system of treatment), as opposed to wasting resources on unguaranteed outcomes.

In the long run, if science provides citizens with healthier solutions for what were supposedly considered to be chronic diseases, they can be more productive and on a societal level the rates of productivity will increase, leading to an economic boost for the whole country.

In an effort to start introducing regenerative medicine in Egypt, the Egyptian government can take gradual steps through this path by enforcing the new law of organ transplant in Egypt while at the same time encouraging people to move towards regenerative medicine. For example, this could be done through awareness campaigns on the benefits on regenerative medicine, cost reduction techniques, basically making the technology more accessible, because it pays off really well.

Controversy has marginalized organ transplant issue for nearly ten years in Egypt due to disparities over the definition of brain death, social inequality to the poor, and other debates regarding the ownership of organs. What regenerative medicine promises is a chance to avoid all these related health, legal, ethical, political, social and economic dilemmas, as it is a life altering breakthrough for many. This is because technology should always play a role in finding innovative ways of improving the life of human beings and contributing to the well fare of mankind.