Two weeks ago, Mr. Lepene, my science teacher, told us a story about a girl named Addie (1). In 2011, Addie Rerecich was just a normal 11-year-old girl who was admitted to the hospital for pain in her hip. After lab reports came back, it was clear that Addie had MRSA (methicillin-resistant *Staphylococcus aureus*), an infection the doctors believed came from picking at scabs. This type of bacteria is extremely difficult to treat because it cannot be killed by common antibiotics. The bacteria had spread to her blood stream. After only a couple days, Addie’s health started deteriorating, FAST! The infection had attacked her lungs. An ECMO (extracorporeal membrane oxygenation) machine was used immediately because Addie could barely breathe. This machine acts as a lung outside the body, oxygenating blood and putting it back into the patient. Even though ECMO is a very effective treatment, it comes with many risks: if bacteria build up in the tubes, it can be easily spread into the bloodstream. Unfortunately, this is what happened in Addie’s case: a few different types of dangerous bacteria got into her bloodstream (2). The doctors put Addie on antibiotic regimen for 3 weeks, which initially seemed to work. However, the bacteria became resistant to antibiotics, forcing the use of really strong antibiotics (that are dangerous to humans as well) to finally clear the infection.

With Addie’s lungs badly damaged, the doctors faced a difficult choice whether or not they should perform a lung transplant on a very sick patient with potentially a very low post-procedure survival rate. In the end, they decided to go with it and Addie received donor lungs. Against all odds, Addie pushed through. But the journey wasn’t over. Addie had to take immunosuppressant medication every day which made her feel tired, nauseous, and irritable. However, not taking her medication was not an option: it suppressed her immune system so that her body wouldn’t reject the foreign body part. Addie lived with donor lungs for nine years but then her body started to reject the lungs. Addie needed another lung transplant. She made a selfless decision to not undergo yet another lung transplant procedure: she believed she already got her second chance at life and she did not want to take this chance from someone else who deserved theirs. Addie Rerecich passed away in 2019.

This heartbreaking story wouldn’t have taken place if there was any one of a few medical advances: 1) a way to prevent bacteria from becoming antibiotic-resistant, or so-called ‘superbugs,’ 2) a way to prevent a recipient’s body from rejecting the donor organ, or 3) donor organs were readily available to people in need. Wouldn’t it be great if we could artificially grow organs using a patient’s own DNA? It would not only eliminate a need for a donor organ waiting list but also drastically increase each patient’s survival rate after the transplant. Since the organ would be grown from the person’s own cells and DNA, the immune system would not reject the new organ. There would be no need for a life-long
regimen of immunosuppressants, which cause health issues in the long term. Obviously, it would allow for not only growing entire organs but also parts of organs could be grown with matching tissue for situations where a full organ replacement is difficult or not needed.

You might think, “Why hasn't this already been thought of?” The research has been going on for over 2 years (3). It's a hard process which takes a lot of time, effort, and money. Once scientists figure out how to artificially grow tissue from one’s DNA in the lab, the possibilities are endless, going way beyond regenerative medicine. It would allow us to artificially grow meat in the lab which, in turn, would eliminate the need for livestock. Growing livestock plays a major role in climate change - it destroys land, water and biodiversity (4). Coming full circle, antibiotics are commonly overused in livestock which we end up consuming with meat and dairy products. This over-exposure to antibiotics creates ‘superbugs,’ antibiotic resistant organisms that causes problems like Addie’s. A summary of how these superbugs arise and can spread from animals to humans and between humans is shown in Figure A. In addition to reducing the number of superbugs produced on farms, lab-produced meat would also resolve a moral dilemma of killing animals for food and garments.

I hope the on-going research and scientific progress will make lab-grown organs and tissue “printed” from one’s DNA a possibility in the near future. Not only would many lives will be saved, but it would also help allow our planet to preserve its biodiversity and slow down pollution caused by raising livestock.

Sources: