

2018 PSBR High School Essay Contest
Grand Essayist

Libby M.

Mt. Lebanon High School
Pittsburgh, PA

My brother, Michael, was born in 1992, skin blue from lack of oxygen, and with a practically nonexistent pulmonary valve. He was put through open heart surgery at the tender age of three months old to correct his Tetralogy of Fallot, which entails a series of mechanical problems within the heart. It includes Pulmonary Stenosis, or partial obstruction of the pulmonary valve which prevents oxygenated blood from reaching the lungs. Additionally, his right ventricular hypertrophy caused the muscle around his right ventricle to thicken, restricting it. The aorta overrides the septal defect, allowing both high oxygenated blood meant for the body and low oxygenated blood meant for the lungs to mix and increase the outflow of blood from the aorta. This series of problems makes it nearly impossible for Michael to access enough oxygen for his entire body without a replacement valve. Even now, at the age of 25, after two operations, Michael's heart cannot pump enough blood to all parts of his body efficiently, causing his fingers and toes to turn to a blue-purple color without proper exercise to force the blood to flow. But Michael is not alone. About 350,000 children are born around the world each day. Approximately one of every 100 of those children are born with congenital heart defects, averaging out to about 3,530 children born every year ("Be Fruitful and" & "Facts Sheets"). They are sentenced to a life full of limited activities, doctor visits, and judgements from others. They are forever separated from the rest of society for something out of their control. Biomedical research is invaluable for millions but especially for those with congenital heart disease. Michael was born with a congenital heart defect, altering my and my family's lives irrevocably. He has been through trials that some people cannot imagine, but he has made it through them because of the research behind his life-saving treatments.

In Michael's first open heart procedure, a pig's valve was used to replace his own. Pigs are very common research subjects because their cardiac physiology is so similar to that of a human's. Though other animals, such as rats or rabbits, have expanded the medical field in hundreds of ways, the pig's valve was the best fit for Michael's heart because of the comparative anatomy and tissue makeup ("Why Swine?"). The research on pigs to discover that one of their valves would be a solution for Michael is priceless.

Biological tissue supplements, such as that from a pig, are incredible advancements, but as with all innovations, flaws accompany. Along with the low possibility of blood clotting, real tissue parts deteriorate much more easily than mechanically printed parts. They cannot last as long, but they function exactly as a normal human's valve would. However, mechanical parts can last longer and do not require any sort of donor. Of course, these benefits come with the cost of indefinite use of blood thinners to allow the replacement valve to work without risk of blood clotting or other problems ("Understanding Heart Valve"). The uses of both mechanical

and biological replacement parts have pros and cons, but the development of both are indispensable.

Some 60,000 American patients are given pigs' valves to replace their own faulty ones ("Pig"). As Michael grew, the pig valve became outdated technology, and at the age of 21, a melody valve was placed in his heart. The melody valve is a section of a cow's vein attached to a metal, wire frame. The valve is inserted in the heart through a part of the cardiovascular system, in Michael's case, a vein in his upper thigh. The catheter inserted will then travel to the heart where it releases the valve and then leaves the body through the small access point somewhere else in the body, such as Michael's upper thigh ("Melody Transcatheter Pulmonary"). The valve functions incredibly similar to the valve of someone born without tetralogy of fallot. Though many animals were lost in the process, their lives saved thousands.

Biomedical research has saved my big brother's life. The research behind animal part substitution and mechanical and 3D printing of anatomical parts has prolonged my brother's life from the moment he was born. Michael's underdeveloped pulmonary valve nearly cost him his life, but with years of research conducted on animals and modern technology, Michael was fortunate enough to receive several alternatives for his pulmonary valve, letting my family and me be grateful for this research every time we see my brother.

References

- "Be Fruitful and Multiply!" *The World Counts*, 14 June 2014, www.theworldcounts.com/stories/How-Many-Babies-Are-Born-Each-Day. Accessed 26 Mar. 2018.
- "Facts Sheets." *The Children's Heart Foundation*, www.childrensheartfoundation.org/about-chf/fact-sheets. Accessed 26 Mar. 2018.
- "Melody Transcatheter Pulmonary Valve (TPV) Therapy." *Medtronic*, 2017, www.medtronic.com/melody/patient/therapy.html. Accessed 22 Mar. 2018.
- "Pig." *Understanding Animal Research*, 22 Apr. 2015, www.understandinganimalresearch.org.uk/animals/10-facts/pig/. Accessed 22 Mar. 2018.
- "Understanding Heart Valve Replacement." *Abbott*, St. Jude Medical Center, 2018, www.sim.com/en/patients/heart-valve-disease/treatment-options/heart-valve-replacement?clset=af584191-45c9-4201-8740-5409f4cf8bdd%3ab20716c1-c2a6-4e4c-844b-d0dd6899eb3a. Accessed 22 Mar. 2018.
- "Why Swine?" *Midwest Research Swine*, US Department of Agriculture, midwestresearchswine.com/why_swine/. Accessed 22 Mar. 2018.