

## Future Problem Solving of Virginia Warm-up Fuzzy - Organ Donation

In July of 2023, Patrick Morrison suffered a massive heart attack. Aside from experiencing the greatest health crisis of his life, Morrison also faced his most difficult decision. When doctors informed him that transplant surgery offered the best hope for long-term survival, they presented him with a number of options, each with its own set of problems.

The first option involved no donor at all. Bionic mechanical organs have improved markedly in recent years. They cost less and function more efficiently than earlier models. However, they still have a high failure rate and lack the comfort and feel of a natural heart. The second option, organs from human donors, offers a better chance of success, but are scarce, hard to match, and prone to early rejection. Despite intensive campaigns to recruit human organ donors, demand always exceeds supply.

Morrison then heard what doctors call the best current solution: xenotransplants — organs donated by animals. Xenotransplantation technology and methodology has progressed rapidly in the twenty-first century. Medical specialists inject DNA obtained from the eventual recipient into an animal fetus (usually a pig) and nurture it to birth. The animal then grows to maturity in a sterilized environment until it is ready for the organ harvest. By "doctoring" a few cells, scientists can grow hearts that are practically identical to those of the human heart patient, yet strong and free from disease. The procedure has become so common that this year (2024) the "manufacture" and sale of pig to human organs is the largest industry in Isle of Wight County, twice the size of the ham and bacon business.

Why pigs? Baboons are genetically closer to humans, but require long periods of gestation and maturation. Pigs not only have a short gestation period (less than four months) and mature rapidly (birth to adult in only six months), their anatomies are also remarkably similar to humans. Additionally, people tend to accept the medical use of swine species because pigs have long been widely consumed as food. Baboons are primates that remind us of ourselves.

For Morrison, the choice seemed obvious. One year after his heart attack, in a surgical suite at the Medical College of Virginia, a generous swine "donated" a heart and saved his life. Actually, three pigs were raised with Morrison's DNA. One was used for his transplant as the other two stood by in case something went wrong. After the surgery, one of the remaining pigs was put on the open market for desperate heart patients too sick to wait for the yearlong process, and the third pig lives on a medical farm in Southampton County, ready for use if Morrison needs a second transplant. Wealthy clients from sports, entertainment, politics, and business have dozens of pigs on standby, with hearts and livers and kidneys ready to be transplanted at any time. Not surprisingly, the pig population has exploded. There are now 7.6 pigs to every human in Isle of Wight County.

In a strange way, Morrison feels like an organ donor himself. The heart he received and the one he gave to another was genetically engineered to be 99.8% his own. The other .2% came from the donor pig, a 300-pound miniature swine. Now vital organs can be transplanted even while the donor still lives.

Morrison owes his life to a pig and to advancements in medical science that have made animal to human organ transplants possible. As xenotransplantation becomes increasingly popular, disagreements over organ donations from animals have also increased. Use your problem solving skills to explore challenges presented by xenotransplant donations from all perspectives, and brainstorm solutions to the challenge you think is most important. Surgeons, the biomedical industry, animal rights advocates, and transplant patients throughout the world will be interested in your action plan.