Xenotransplantation Case Study Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per #\_\_\_\_\_\_\_\_\_

**Could this pig save your life? A True Story……..**

Robert Pennington was a normal healthy 17 year old working in a family-owned carpet store when he came down with what he thought was the flu. After a few weeks, he was not feeling better, and in fact he felt much sicker. A glance in a bathroom mirror revealed that the whites of his eyes had turned yellow.

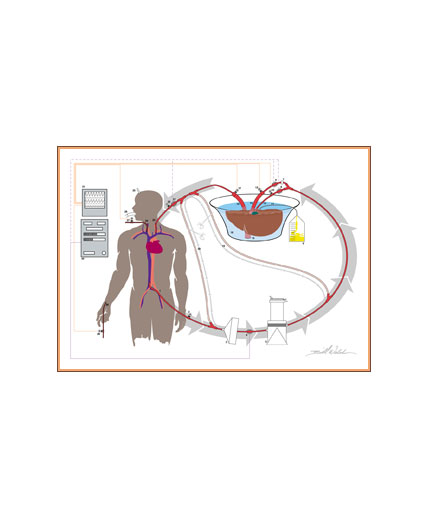
Alarmed, Robert went to a local medical clinic where the physician saw him. The doctor examined Robert and asked for a urine sample. Astounded by the coffee-colored brown urine sample, the doctor referred Robert to a specialist. Four days later, Robert was admitted to Baylor University Medical Center diagnosed with sudden and overwhelming liver failure.

Dr. Marlon Levy, a transplant surgeon at Baylor, knew that Robert would die in a few days without a liver transplant and reacted immediately by placing Robert at the top of the transplant list. However time was critical since Robert was showing signs of acute ammonia poisoning as a result of the liver’s inability to clean toxins from his blood. He was already hallucinating and approaching a comatose state. Dr. Levy soon realized that no human liver would be available in time to save Robert’s life.

Dr. Levy began to evaluate another possibility. An experimental procedure that uses a **transgenic** pig liver had been approved by the FDA for testing at Baylor Medical Center. This research was funded by a company that had developed a process to insert human genes into pig liver cells to prevent humans from rejecting a transplanted pig liver. The company then sought research hospitals willing to test the transgenic pig livers on humans with liver failure who needed a new organ. The data collected and the outcomes of these experimental surgeries, if positive, would be submitted to the FDA to support a marketing application.

The company had shipped the transgenic animals to the Baylor animal labs and they were there at the time that Robert Pennington was admitted to the hospital. Dr. Levy had also been trained in the use of these pig livers. This procedure involves removing the patient’s blood through plastic tubing and cleansing it by passing it through the pig liver before returning the blood to the patient. This is a temporary measure referred to as a “bridge to transplant”, and it is intended to support liver function and the patient’s life until a suitable human liver can be found.

Within a short time, Robert lapsed into coma and was placed on life support. Dr. Levy notified Robert’s grandmother, his guardian, that she was needed in the intensive care unit for a discussion on Robert’s condition. Charlotte Pennington listened as Dr. Levy explained the procedure. He also explained that, since the procedure was new, there were unknown risks that included the possibility that some dangerous animal viruses might infect Robert. He would need to be tested for animal source infections possibly for the rest of his life. Dr. Levy also told Mrs. Pennington that Robert would be his first pig liver transplant patient. Mrs. Pennington gave her consent the next morning.

Dr. Levy then removed the liver from a 15-week-old, 118-pound transgenic pig from the Baylor animal lab and moved it to Robert’s bedside to be used as Robert’s external support liver. Shortly after the liver was attached to Robert through the plastic tubing, the blood was “filtered” through the pig liver for 6.5 hours over three days.\*see figure 1\* At that point, a suitable human liver for Robert was found in Houston and delivered to Baylor for transplant. The transplant was successful and Robert made a full recovery. However, no one could forget that his survival was due to the experimental procedure Dr. Levy used to keep Robert alive until the human liver was found. In fact, Robert’s grandmother keeps a snapshot of the pig, named Sweetie Pie by one of Baylor’s animal handlers, in a scrapbook. 

Sailing into uncharted waters, Pennington (with his grandmother) was the first subject of an experimental procedure in which his blood was circulated through a pig’s liver outside his body. While all went well with Robert Pennington (and another 5 patients who received the same experimental surgery), the FDA shut down the perfusion trial three weeks after Robert’s procedure. A group of virologists in England found evidence that human cells could be infected with PERV (porcine endogenous retroviruses) in test tubes and that the genes from two separate viral strains had been found in several varieties of pigs, making it unlikely that pigs could be bred to remove the virus.

No one knew at the time whether PERV could make humans sick but precaution seemed justified. Ultimately, the FDA lifted the ban when companies producing transgenic pigs developed a PERV detection test for both pigs and patients. Yet, this test alone did not resolve concerns about the infectious risk. The fact that PERV had been undetectable with any test for many years led researchers to suspect that pig tissues could harbor other unknown infectious agents.

\*from Stolberg, S.G (1999) Could This Pig Save Your Life?, *New York Times*, October 3.

1. What is the function of the liver?

2. What is meant by “transgenic”, “xenotransplantation” and “retrovirus”? Search for the definitions.

3. Why do you think pigs were chosen as opposed to another organism?

4. How should we balance the potential benefits of genetic engineering with the possible risks to public safety?

5. What might be the therapeutic worth of using pig livers as bridge transplants as opposed to mechanical devices?