Class Starters & Enders

Making the Most of Instructional Time
Five Minute Lessons

Class Starters and Enders help utilize the last minutes of class when a lesson ends but there is not enough time to start another, or for an interest approach at the beginning of class. Mini-lessons correlate to GPS in the programs areas below.

Transgenic Xenografts

Program Areas: Biotechnology, Healthcare, Agriculture, Engineering & Technology

Instructions: Read the narrative and make notes of important points, answer questions, if provided, and be ready to discuss this topic.

"The creatures outside looked from pig to man, and from man to pig, and from pig to man again; but already it was impossible to say which was which." –George Orwell, Animal Farm (1945)

Persons who need organ transplants often wait on long lists for available donors; as of 2010, the list for kidney transplants is more than 80,000 people long, and about 30% of people awaiting such transplants die before receiving one. This high demand has created a market for unethically obtained organs, such as those taken from prisoners or even murder victims and implanted in countries with little regulation. As a way of alleviating this shortage, one alternative is the use of animals as organ donors, known as **xenografts** or xenotransplants. The most desirable donors would be chimpanzees, as they are genetically very similar to humans and have similar blood characteristics and physiology, but they are an endangered species and also present ethical issues due to their relatively high intelligence. Baboons might be the next-preferable, but they are significantly smaller and difficult to breed. Using non-human primates also carries the danger of **zoonotic** disease transmission. The best donor animal under these cirumstances, and the one currently used in xenographic research, is the pig. Pig organs are similar in size to those of humans, pigs are plentiful and easy to breed, and generations of contact between humans and pigs, in addition to the larger genetic disparity, reduces the chance of disease transmission. Additionally, there are few moral objections to harvesting organs from pigs, as they are already used as food animals.

Xenografts have been attempted since 1906; surgical procedures have been sufficiently sophisticated since that time, but another problem emerged which has yet to be solved: **rejection**. Rejection occurs when the recipient's immune system recognizes the transplant as foreign material and attacks it. This eventually results in organ failure and death. In an attempt to manage rejection, one strategy is to give the patient **immunosuppressant** drugs, but this naturally leads to complications such as increased risk of infection and opportunistic diseases. It would be preferable to find a way for the body to accept the organ as if it were native tissue.

The first **transgenic** pig was born in 1985; by inserting additional genes into pig embryos, researchers were able to produce a pig that had the genes of their choice. Since then, refinements to the technique have produced such innovations as pigs that glow in the dark and pigs with more environmentally-friendly waste. Researchers are pioneering research into creating "designer" pigs; these pigs would be modified with the recipient's DNA as an embryo and then grown for the purpose of harvesting their organs for transplant. Because the pig would contain the recipient's DNA, the body would be less likely to see it as foreign; the rejection response could be expected to be weaker, and eventually may be eliminated entirely.

Review

1. What is the motive for researching xenographic transplants?
2. What animal would be the best organ donor for humans, and why?
3. Why is this animal not currently used as a donor?
4. What animal is currently used in xenographic research, and why?
5. What causes xenografts to fail?
6. How is this issue managed; what are the consequences of managing it?
7. What is a transgenic animal?
8. What is a "designer" pig?
9. Why would designer pigs be better sources of xenografts?
10. If an immediate family member were on a waiting list for an organ transplant and an organ from a designer pig were available, would you want them to take it? Why or why not?

Language Connection

Research and write definitions for the terms in notes.

Immunosuppressant
Rejection
Transgenic
Xenograft
Zoonotic

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