

The logo for the FRONTLINE television series, featuring the word "FRONTLINE" in white, bold, sans-serif capital letters centered within a solid red square.

ORGAN FARM

**PBS AIRDATES: Tuesday, March 27, 10 P.M., 60 minutes (Part I)
Tuesday, April 3, 10 P.M., 60 minutes (Part II)**

Imagine a world in which every patient who needed an organ transplant could receive one on demand and a surgical procedure could cure everything from strokes to spinal cord injuries to Parkinson's Disease. Such a future may not be far off thanks to the development of cross-species transplants using live pig cells, tissue, and genetically modified pig organs.

But while a scientific breakthrough in cross-species transplants—known as xenotransplantation—could offer hope to millions of desperately ill patients, such procedures could also introduce a new virus into the human population, posing a public health risk to millions of others. In “Organ Farm,” airing Tuesday, March 27, and Tuesday, April 3, at 10 P.M. on PBS (check local listings), FRONTLINE offers viewers an inside look into the highly secret, multibillion dollar xenotransplantation industry. With exclusive access to a secret transgenic organ farm and never-before-seen footage and photos of these cutting-edge experiments, the special two-part documentary takes viewers inside the bio-secure, airlocked world where science fiction may soon become science fact.

“Viewers may be surprised to learn just how far scientists have come in developing and replicating pig organs for use in human beings,” says FRONTLINE senior producer Ben Loeterman. “The science is rapidly moving towards the creation of a living production line of transplant organs to use as spare parts for humans.”

“Organ Farm” visits several experimental facilities where pigs are genetically modified for use in humans. Because a human body would immediately reject a pig organ as foreign, these “transgenic” pigs are genetically altered with human DNA in the hope that a human recipient's body will be fooled into thinking the organ is human.

But while whole-organ xenotransplants are still on the horizon, the transplantation into humans of live pig cells and tissue—which the body does not reject—is already underway in

carefully monitored clinical trials. In “Organ Farm,” viewers follow several patients who participate in these experiments. For many of the participants—including two stroke victims and a man incapacitated by severe Parkinson’s Disease—xenotransplantation was their last hope.

Maribeth Cook was just thirty-four when a stroke left her paralyzed on her left side. “My doctor told my parents and my husband to put me in a nursing home,” Cook tells FRONTLINE. “[They said] I’d never be able to do anything I’m doing now.”

A year and a half ago, Cook became the first stroke victim to have thirty million fetal pig cells implanted into the stroke-damaged part of her brain. The results were dramatic. Since undergoing the experimental procedure, Cook no longer needs to use a wheelchair. In fact, she recently completed a half-marathon.

Paul Cook, Maribeth’s husband, comments: “It’s just amazing to see the condition she’s in today, mentally and physically, since this pig cell transplant.”

Perhaps the greatest promise offered by xenotransplant research, however, is the hope that genetically modified pig organs could potentially save the lives of thousands of patients who die each year because no human donor organs are available.

Professor Robert Michler, chief of cardiothoracic surgery at Ohio State University Medical Center, estimates that in the United States alone there are approximately 70,000 patients with end-stage heart disease who could benefit from a heart transplant.

“In this hospital, people die every single day for want of an organ,” Michler says, “because they didn’t have an appropriate donor [and] there are patients on the waiting list.”

While transgenic pig organs have yet to be transplanted into human recipients, they have been used outside the body. In “Organ Farm,” viewers meet Robert Pennington, who in 1997 nearly died at age twenty from acute liver failure. By hooking Pennington up to a transgenic pig liver outside of his body, the doctors at Dallas’s Baylor University Medical Center were able to keep him alive for three days until a human liver was found. The ground-breaking operation also gave researchers the opportunity to study how transgenic pig organs might react in a human recipient.

Despite the potential benefits of xenotransplantation, however, the procedure is not without controversy. Because pig cells and organs contain a unique virus within their genetic material, some fear that transplant recipients would not only contract this virus—known as Porcine Endogenous Retrovirus, or PERV—but also possibly spread it among the general population.

“The ultimate concern is that you create AIDS II by doing xenotransplantation,” says Hugh Auchincloss, surgical director for transplantation at Massachusetts General Hospital and chairman

of the FDA’s subcommittee on xenotransplantation. “And nobody is quite capable of saying that’s impossible.”

Some of the experiments surrounding xenotransplants involve attempting to remove or render ineffective this virus, which is found in every cell of a pig. But the fear of starting a new, unstoppable swine-based epidemic could soon be academic: In “Organ Farm,” FRONTLINE visits the Boston-based Biotransplant, Inc., which has developed a quarantined herd of miniature swine with a unique characteristic.

“People are very interested in these animals because this is the first breed of pig which...seems to lack any pig virus that will infect human cells,” says Dr. Clive Patience, principal scientist for Biotransplant, Inc. “If these animals really do lack the infectious virus, then I would see them as, ultimately, the safest breed of pig to use for xenotransplant.”

The development of xenotransplantation has come under attack by animal-rights’ groups, which have decried the extensive experimentation on wild primates and pigs in the name of scientific advancement.

“I don’t think that animal experiments can ever be justified,” says Dan Lyons of the animal-right group Uncaged Campaigns. “The deliberate infliction of violence, suffering, and death on another is wrong, you know, be it a human or any kind of animal.”

In “Organ Farm,” FRONTLINE goes behind the scenes at facilities conducting the controversial animal experiments, giving viewers the chance to view the experiments in progress. Scientists engaged in xenotransplant research do not completely refute the charges made by animal rights activists.

“We have to be frank about this: We are exploiting these pigs,” says Dr. David White, director of research at Imutran in Cambridge, England. “But I believe it’s far more justifiable to exploit these pigs in order to save people’s lives than for the production of food.”

White believes the benefits promised by xenotransplantation far outweigh any concerns of animal exploitation. “Animal-rights activists have a right to reject for themselves the product of medical research on animals,” he tells FRONTLINE. “But I don’t accept that they have a right to prevent the general population from benefiting from what medical research can bring to the population at large.”

Animal-rights groups, however, counter that it’s an expected multibillion dollar market for transgenic organs that is behind xenotransplant research, not altruism. “It’s that huge pot of gold which is driving this,” Dan Lyons tells FRONTLINE. “No doubt about it.”

It’s a debate that has both sides frustrated—particularly doctors and researchers, who say

that every moment spent arguing over the ethics of animal experimentation delays a scientific breakthrough that could revolutionize medicine and save millions of lives.

“What we must face is the fact that every seven minutes during the course of our debate, someone dies who could benefit from a ...transplant,” says Professor Michler of Ohio State University Medical Center. “So the clock is ticking.”

Following the broadcast, access the “Organ Farm” Web site at www.pbs.org/frontline for more on this report including:

- A history of xenotransplantation attempts in the twentieth century and a closer look at the regulatory and ethical issues surrounding cross-species transplants.
- Interviews with doctors and xenotransplant researchers.
- Reports and interviews on the animal-rights issues.
- A summary of the business and economics of cross-species transplants, the sources of research funding, anticipated profits, and future costs for patients and the healthcare system if xenotransplantation proceeds.

“Organ Farm” is a Carlton Television production for WGBH/Frontline. Ben Loeterman is senior producer for Frontline. Frank Simmonds is producer/director for Carlton Television. Michael Chrisman is senior associate producer for Carlton TV.

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