

WESTERN WASHINGTON AWARD WINNERS

FIRST PLACE ESSAY

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Pancreatic Cancer

Ten years ago, when I was 4 years old, my parents told me that my grandmother, who was only 63, had been diagnosed with pancreatic cancer. After suffering horribly for 6 months, she died. In November of 2008, my grandmother's sister was also diagnosed with pancreatic cancer. She died 2 months later. Every year, 42,470 Americans are diagnosed with pancreatic cancer, and 35,240 of them die. The survival rate for pancreatic cancer is a mere 4.6% over 5 years. According to the Pancreatic Cancer Action Network, the 5-year survival rate has only increased 2% since 1975 and the number of new cases is expected to rise 55% by the year 2030. It is the 4th leading cause of cancer deaths in men and women in the United States.

The pancreas is a very important gland near the stomach that produces and delivers digestive enzymes to the intestine through the pancreatic duct. It also produces insulin, which regulates blood sugar. As with any organ, cancer can develop within it when some cells begin to grow uncontrollably. Symptoms of pancreatic cancer include weight loss, loss of appetite, depression, upper abdominal pain, and jaundice, or yellowing of skin and the whites of the eyes. Unfortunately, these symptoms are usually not seen until the cancer is advanced. Race, age, obesity, smoking, and a personal family history of pancreatic cancer or genetic syndromes are all risk factors for developing pancreatic cancer. Treatment includes surgery, radiation therapy, and chemotherapy. Surgery can often not be performed because the cancer has spread beyond the borders of the pancreas. Radiation therapy uses radiation to destroy cancer cells, and chemotherapy uses cytotoxic drugs to kill cancer cells.

Pancreatic cancer is one of the most aggressive and lethal cancers, because it is often not diagnosed until later stages. Symptoms often occur late, and there are no good screening tests to provide early detection of the disease. There are several areas of promising research involving pancreatic cancer using both humans and animals. The NIH website lists 782 current studies involving pancreatic cancer. In 2008, Bert Vogelstein, M.D., at Johns Hopkins School of Medicine completed the Pancreatic Cancer Genomes Project. They determined the sequence of 20,000 genes associated with 24 pancreatic cancers taken from real patients. The hope is that

this will help further scientific research to develop both better tests for early detection using blood or other body fluids and new treatments. For example, K-ras is one of the commonly mutated genes seen with pancreatic cancer. Researchers are trying to develop treatments that target this gene.

Researchers are also using animal experiments to find new treatment options. The Seattle Cancer Care Alliance (SCCA) produced a pancreatic cancer in mice that is extremely similar to the disease in humans. SCCA is using this model to develop treatment for cancer in both early and late stages. Canadian researchers have been doing similar research. On January 20, 2010, Critical Outcome Technologies Inc. (COTI) reported positive results from animal experiments. They used animal model of human pancreatic cancer to test the effectiveness of a chemotherapy drug, COTI-2, as a single agent and in combination with another drug, Abraxane. Their study suggests that these drugs may help in treating pancreatic cancer.

Finally, another important area of research is developing better diagnostic tests for pancreatic cancer. Researchers recently developed a new test to help diagnose pancreatic cancer in earlier stages. For the first time, this test may indicate the presence of pancreatic cancer by detecting increased amounts of a protein in the urine. Hopefully, this will discover cancers before it is too advanced to be surgically removed. Other research to develop other simple tests for early detection is needed.

Pancreatic cancer is a very lethal disease that kills many Americans annually. Progress in developing new treatments and early detection has been limited. Hopefully continued research will bring new advancements that will help fight this deadly disease.

Reflective Paragraph

I chose to write about pancreatic cancer because both my grandmother and great aunt died as a result of it. This disease robbed me of my only living grandmother when I was only 4. I knew that pancreatic cancer was particularly aggressive and had a terrible prognosis. But I didn't realize how common it is and how many deaths it causes every year. I think it is sad that we don't have very many successful treatments for it or any way of detecting early enough to cure it. I think it is encouraging that we are moving forward with research into the causes and possible treatments for pancreatic cancer but think we need to make an even greater effort. Since pancreatic cancer can run in families, I am worried that other people in my family or I may someday have to deal with it. There are also thousands of other people that will also have to face it in their lives. Hopefully, our research will discover better tests to detect it earlier and find better treatments once it's been diagnosed.

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SECOND PLACE ESSAY

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Deep Brain Stimulation

Parkinson's Disease, or PD, is currently affecting six million people worldwide. It is a difficult disease to diagnose, so the numbers could be much higher. My grandfather was diagnosed with PD in 2000, and three years ago he was diagnosed with Dystonia (another crippling movement disorder). Deep Brain Stimulation is a procedure that was created to help control all sorts of movement disorders including PD and Dystonia. Deep Brain Stimulation, or DBS, was first used to treat PD in 1987, although reports weren't published until 1993. It has now been almost a year and a half since my grandfather underwent Deep Brain Surgery to treat his disorder. The procedure involves placing two electrodes on either side of the brain and then running a wire connecting the electrodes to two battery packs located under the skin on either side of the chest. This innovative surgery is offering hope to PD patients who have reached a point of desperation.

DBS is a great example of interplay between basic and clinical science as a two-way process. A study involving drug addicts with Parkinson-like symptoms led to a perfect monkey model for PD, and after four years of intensive studying, brought out an approach for patients. In 1983, the compound MPTP was discovered to be the source of PD-like symptoms in drug addicts. Later on that year, scientists were able to create a primate model for PD testing by injecting MPTP into monkeys and selectively destroying some of the monkeys' dopamine producing neurons. Observations were made of the basal ganglia (a group of structures linked to the thalamus in the base of the brain and involved in coordination of movement) of both normal monkeys and the MPTP-injected monkeys. These recordings showed that the MPTP monkeys had a pronounced over-activity of the subthalamic nucleus (or STN) portion of the brain. In 1990, electrical stimulation of the STN proved to reverse the effects of the dopamine-killing MPTP. These findings in Monkeys led to the first DBS surgery on human patients with PD. The procedure was carried out on three different people, with DBS electrodes placed on either side of the brain, which is now the standard approach in PD patients. In 1997, the FDA approved DBS surgery in the thalamus and then in 2001, approved DBS in the STN as well. Almost all of the evidence to support these procedures came from the animal trials.

My grandfather was diagnosed with Parkinson's in 2000 and with Dystonia in 2007. Before he turned to DBS, he had tried many procedures to treat his PD and Dystonia. He had gone to over a dozen different chiropractors, had Botox injected into the muscles in his back, and even tried several acupuncture techniques. He was on nine different medications, which were having serious side effects, including terrible hallucinations and extreme fatigue. When nothing worked, he started to look into DBS. He underwent the surgery in November of 2008 and experienced some major improvement in his condition. He was able to completely come off three of his medications and the remaining ones have been reduced by over fifty percent. His tremors have completely stopped. Although the Dystonia hasn't improved yet, my grandfather is still patiently waiting. A man in the Midwest with Dystonia underwent the same procedure and didn't see improvement until three and a half years later; so there's still hope.

DBS is now used worldwide. Current estimates are that about 20,000 people have been treated with DBS. It is not a cure for PD but it can alleviate some of the most obvious symptoms giving patients a much-improved quality of life. DBS has greatly helped many people with their movement disorders and their families; including mine.

Reflective Paragraph

Through researching and writing this essay I have learned how DBS surgery can improve the lives of suffering people. I am so grateful for all it has done for my grandfather and the hope it has given him. DBS has also provided hope for thousands of other people desperate for effective treatment for their debilitating movement disorders. Innovative medical breakthroughs, such as DBS, would never happen without the painstaking work of research scientists who are challenged to discover new treatments. Who would have ever thought that you could place electrodes directly into the brain and use that electricity to treat diseases? It certainly makes you wonder what's next.

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THIRD PLACE ESSAY

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Drug-Resistant Tuberculosis: MDR/XDR TB

You're sick. Severe coughing, fever, night sweats, an overall feeling of fatigue, but this time it's different. A week's rest and Dayquil don't improve the condition. Frustrated that the illness continues to worsen, you visit the doctor. A few tests later, the doctor announces that you have tuberculosis or TB, a bacterial infection caused by *Mycobacterium tuberculosis*. "What?"

You think: "I thought TB was eradicated years ago!" While many people in developed countries believe this, in fact one third of the world's population has TB, and there are almost two million TB-related deaths worldwide per year, about five thousand per day. For decades, TB has been partially controlled by vaccines and antibiotics, but new drug-resistant TB is now a growing public health concern 50 years after TB was thought to be almost eradicated.

Evidence of tuberculosis has been found as far back as 2400 BCE in Egyptian mummies and Greek literature. Fast forward to the early 20th century when TB was thriving. In 1921, a breakthrough was introduced, the Bacille Calmette Gurin or BCG vaccine which became available after testing. Still widely used today, the vaccine was made using weakened bacteria similar to *M. Tuberculosis*, which is weak enough to not make one sick, but still prepares the immune system to fight *M. tuberculosis* when it strikes. Unfortunately, the BCG vaccine had a low success rate, often below 80 percent, so people continued to contract TB.

In November of 1944, the first antibiotics were shown to treat tuberculosis. With the development of antibiotics, the TB problem was considered solved, and scientists turned to other diseases. However, tuberculosis soon posed a new threat, as many strains of TB became resistant to the drugs treating them. There are two types of drug-resistant TB: multi drug-resistant tuberculosis, or MDR-TB, and extensively drug-resistant tuberculosis, or XDR-TB. These drug-resistant strains can arise from a number of causes including skipping medications, not completing treatment, or using improper medication. Because there are only a few effective alternative drugs for treating these drug-resistant strains, TB is making a comeback.

Today, scientists are working on vaccines and treatments for the new drug-resistant strains. Scientists are making the vaccine stronger through autophagy, a recycling process in which body cells turn damaged cell pieces into new building blocks. Not only are the vaccines being improved, but the delivery systems are also being revised. At Harvard School of Public Health, bioengineers have found a new method for delivering vaccines through a dry-spray technique rather than needles.

This dry-spray delivery method proved more effective than injections when tested on guinea pigs, and hold numerous benefits including better heat stability and a sterile alternative to needles which can pass blood-transmitted infections or diseases if unsterile. These developments in vaccines and vaccine delivery may lower TB rates and help improve vaccines for other diseases.

The recommended tuberculosis treatment consists of 6-12 months of antibiotics. With proper antibiotic treatment, TB is curable. However, when a patient skips the medications or stops treatment early, the TB can become drug-resistant and much harder to treat. Other antibiotics have been introduced for MDR or XDR-TB, but these are often less effective. In response to these drug-resistant strains, many new TB antibiotics are currently being tested and developed. Scientists have found a new antibiotic, diarylquinoline, that can work against both drug-sensitive and drug-resistant *M. Tuberculosis*. Diarylquinoline is currently in Phase II clinical trials and, when tested on mice, proved more effective than traditional TB antibiotics. Other antibiotics are also in early stages of testing.

Strains of drug-resistant TB are constantly posing new threats to the world's population. Through animal testing, new treatments and delivery systems are being developed which may hold the key to eradicating TB. By creating new treatments and broadening access to TB vaccines and antibiotics, especially in developing countries, we may be able to control these new drug-resistant strains and eventually eliminate tuberculosis throughout the world.

Reflective Paragraph

I was very interested to learn about Tuberculosis. Before researching it for my paper, I knew nothing about TB, excluding a couple brief references in episodes from the recent T.V. show House. For a long time, I have had a specific interest in public health and healthcare in developing countries. Organizations such as Doctors Without Borders continue to interest me, and I took this assignment as an opportunity to see if I'm actually interested in it. Initially, I was hesitant to choose this topic based on the somewhat obvious missing part of the assignment: Biomedical Breakthroughs and My Life. How does TB affect my life? Well since then, I've learned how while this topic may not have affected my life in the past, TB very well may affect my life in the future as a profession in public health or other related studies.

In researching this project I have not only learned a lot about tuberculosis, but I have also learned a lot about problems with access and distribution that also serve as barriers in other diseases. These areas specifically interest me, and by studying this individual disease I have widened my scope to realize how many of these common issues with TB overlap into other diseases and areas of health. Diseases such as Methicillin-resistant *Staphylococcus Aureus* or MRSA, and two of the four human malaria parasites are only a few on a list of many. I am glad to have had the opportunity to research tuberculosis and am extremely interested in this area of medicine. TB may not have affected my life so far, but I am fairly confident to say that TB will affect my future if I pursue a career in public