APA FORMAT Student Example

Running Head: ZOMBIES: MODERN DAY MONSTERS

Zombies: Modern Day Monsters

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April 10, 2007

Monsters have been around for quite a while. From the beginning of time, man has told stories intended to scare other people for one reason or another, and monsters have always proved effective. The invention of the motion picture allowed the "horror movie" to take the world by storm, making famous certain monsters such as King Kong and the Creature from the Black Lagoon. Recently, however, modern movie-goers seem to need something a little more believable to produce the required feelings of terror that keep them coming back for more. To compensate for this paradigm shift, yesterday's horror movie has evolved into today's "psychological thriller". Today's movies must have more realistic plots to bring in the fans. Gone are the days of Godzilla; nobody believes that a giant T-rex will ever attack a city. So what kind of monster can you use to terrify a society that doesn't believe in monsters? What if you can disguise the monsters as… human?

The zombie seems to be today's monster of choice. Zombies are not pre-historic giants or radioactive sea creatures, but humans like you and I. How these humans became zombies depends upon the plot they are involved in, but the good stories have to be at least somewhat based in fact. The 2007 film I am Legend is one example. In the film, scientists successfully modify the smallpox virus to target and kill cancer cells. While the world celebrates a cure for cancer, however, the unthinkable happens. The virus mutates, and with devastating results. Patients begin to get sick. Elevated temperature and heart rate are followed by over aggressive behavior. Hair loss and sensitivity to the sun follow, as mental capacity quickly degrades. The virus continues to mutate and becomes contagious and airborne, spreading with the speed and fury that smallpox is known and feared for. Quickly, the search for a cure begins, but no scientist has ever seen anything like it. This virus is not a product of nature, but of man, and all attempts to stop it are unsuccessful. The film opens 3 years after the outbreak, and Dr. Robert

Neville, possibly the last man on earth, is introduced. Dr. Neville continues to search for a cure by day, while evading the zombies by night. This movie was successful not because of the zombie, but because of its appeal to reality. It made you leave the movie theater wondering, "Could this really happen?" Theoretically, the answer is yes. Recent advances in science and medicine prove that such a prediction may not be that far from reality.

Mayo Clinic researchers are doing just that, experimenting with viruses to target and kill cancer cells. Recent work has been done with the measles virus, retargeting it to recognize cancer cell receptors, allowing selective killing. In this way, retargeted cancer-killing viruses help the body, rather than harming it as natural viruses do when they infect cells (Mayo Clinic, 2005). Just retargeting the virus isn't enough though. Most people receive a vaccination for measles as children, which means that the body quickly recognizes the virus, and kills it before it can reach the cancer. To overcome this obstacle, scientists are using tree and animal viruses to change the protein coat around the measles virus, so that it cannot be recognized by the human immune system. This would allow the virus to reach the cancer successfully, but would spell disaster if something were to go wrong. There are multiple safeguards in effect for this very purpose. Other research is being done with viruses such as HIV, a virus the human immune system already has a hard time fighting off. UCLA researchers have already had success in using HIV based viruses to target prostate and melanoma cancers in mice, without infecting the rodents with AIDS (Tomkins, 2005). Only the future will tell the effectiveness of this research; clinical trials started in March of 2007.

The technology that makes research like this possible is called Recombinant DNA Technology. Recombinant DNA Technology represents limitless possibilities in the field of Genomics. With the successful mapping of the human genome, as well as the genomes of

several other model organisms, recombinant DNA technology may soon play a major part in all aspects of science and medicine. Scientists can now synthesize a strand of DNA for a specific gene, and then implant that DNA into bacteria. First, the DNA is placed in a "plasmid". The bacterium then absorbs the "naked" DNA in a process called transformation. Once the bacterium has absorbed the DNA, it will be replicated as the bacterium undergoes binary fission. This process has resulted in DNA libraries, housing thousands of bacteria and respective DNA strands. Scientists are now working on ways to introduce this new DNA into living cells, and program those cells to express the gene product. This was first successful in plants, such as "golden rice" which was modified to produce beta carotene, which will help fight vitamin A deficiency in third world countries. There have also been recent successes in bacteria and animals, such as E. Coli that produces human insulin, or goats that produce spider silk in their milk. The hope is that in the future, this process will allow us to repair or replace defective human genes.

Scientists have also made discoveries in recent years allowing them to understand the exact mechanisms by which viruses infect their host cells. This has allowed researchers to begin do design their own gene delivery devices (National Science Foundation, 2004). It is technology like this that makes it possible for scientists to "retarget" viruses. Viruses are equipped with certain receptors that recognize and lock onto specific proteins on cell surfaces. These viruses are called phages. Phages specifically target and destroy or alter cells. A "lytic" phage binds to a cell, and injects its own DNA. Inside the cell, the DNA is replicated and used to create more phages. Up to 200 offspring can result from one phage. When these new phages are complete, they break out of the cell, destroying it in the process (Thiel, 2004). Scientists can now manipulate these receptors to make the virus target whatever cell they choose. This is how

researchers at UCLA can use the same virus to target either prostate or melanoma cancer cells.

Technology is a wonderful thing, and is allowing us to explore avenues that have only been dreamed of in the past. Along with these discoveries, however, comes much that we don't understand. It is the question of "what if?" that gives the zombie it's power. If we can engineer a virus that is unlike anything found in nature, and completely invisible to our immune system, isn't there potential for an epidemic of epic proportions? Theoretically, yes. Realistically, probably not. Scientists have many safeguards in place to protect from any such supervirus, and their methods must go through rigorous approval procedures before they can ever begin human trials. The real potential for danger, however, lies with those who may want to engineer a supervirus on purpose. Biological warfare has been feared for years as a potential threat, and with all of this new scientific knowledge readily available to the public, that threat is becoming more and more legitimate. In 2002, scientists created a live polio virus from common chemicals and publically available genetic information. The genome sequence of polio is available on the internet, and genetic material is available from many companies that sell made-to-order DNA. Researchers fear that in the near future, as little as two skilled workers in a rogue lab could synthesize a virus as complicated as ebola (Pollack, 2002). The purpose behind this project was to prove to the government and the world that bioterrorism is a new reality, and must be taken into consideration. When interviewed, the scientists commented that the process is relatively simple, and easy to do, and that the world had better be prepared (Whitehouse, 2002).

As our knowledge of genetics advances, the possibilities are becoming limitless. Recent discoveries have proven that we can create our own viruses, change their DNA to do whatever we want to, and change their structure to target whatever cells we choose. This kind of information in the wrong hands creates a realistic potential for human zombification. Let's

consider two possibilities. There are already naturally existing viruses and bacteria that have neurological effects on humans. The rabies virus, for example, has much the same effect on humans as it does on animals. Symptoms include increased temperature and heart rate, as well as irritability and increased aggressive behavior. Foaming at the mouth is followed by hallucination and dementia, which precedes coma and death. Human to human infection is not common, but the most effective way would be through biting, as the virus resides in the saliva. Genetic modification of this virus that allowed it to keep the host conscious, rather than resulting in a coma, would be a big step in creating a real life zombie. Further engineering allowing the virus to be transmitted easily from host to host would be all we need to bring the I am Legend story to life. One other possibility is with a bacterium called toxoplasma gandii. Bacterial infection was the basis for the plot of the original book I am Legend by Richard Matheson. In his book, the contagious bacterial infection spread so rapidly in the body that it would keep it's host alive even after its heart had stopped beating. T. gandii, while nowhere near as powerful as the bacteria in Matheson's novel, has a very interesting lifecycle. It lives in the intestinal tract of cats, which is the only environment where it can survive and sexually reproduce. When the bacterium is expelled with the cat's waste, it then infects any warm blooded organism that it comes into contact with it. When transmitted to rats, for example, it seems to develop a mind of its own, and formulates a plan to return to the cat where it can survive. The bacteria essentially hijack the rat's brain function, and eliminate its fear of cats. Infected rats, rather than avoiding cats for survival, become attracted to them, ultimately leading to their death and returning the bacteria to an environment where they can survive. Interestingly enough, rats are noth the only animals that seem to be effected by the bacteria. Many humans come into contact with cat feces, and contract a condition called Toxoplasmosis. Presence of the bacterial parasite in humans has

recently been linked to certain neurological disorders such as schizophrenia and bi-polarity (Petty, 2006). Who knows what could be done if T. gandii's DNA was modified with the purpose of affecting the human brain. The thought of a parasite that could remove our fears and inhibitions, and make us act contrary to our instincts for the purpose of its own survival is a pretty scary one.

So how real is this threat? Should we expect a zombie epidemic in the next few years? Realistically, probably not, but science is continuing to prove to the world every day that anything is possible. At this very moment, revolutionary discoveries are being made with DNA that will soon change the world. But there is always a dark side to knowledge. The same technology that may soon allow us to choose the gender, and even physical attributes of our children before they are born will also allow scientists to change the genetic makeup of already living individuals. It may be that we are fast approaching the day when terrorist facilities previously used to weaponize uranium are turned in to labs used to synthesize viruses. Yes, we may cure cancer, but will we create something worse? Only time will tell.

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