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Are Vaccines the Key to Alzheimer's Treatment? (2019-2020)

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“Are Vaccines the Key to Alzheimer’s Treatment?” Myia Tyler (research inquiry example)

Questions to Consider For Discussion and Reflection

As you read Tyler’s research inquiry essay, consider:

- Tyler’s interest in Alzheimer’s is rooted in her sad personal experience with the disease, but she uses research inquiry to extend the narrative of her family’s story in two new directions. The first of these new directions explores her own growth as a researcher; the second new direction discusses a frontier in Alzheimer’s research. How does Tyler’s treatment of these different and yet connected rhetorical contexts evolve? How does her chosen strategy—moving from the personal to the scientific—affect your experience as a reader? Thinking about your own research inquiry topics, how might you adapt her model in your own work?
- Tyler’s writing exhibits a great deal of what we call metacognitive self-reflection. What is this? As part of that metacognitive awareness, the exploration of her research questions provides a window into the ways in which her questions were refined over time. She admits to experiencing frustration and even to wanting to drop her topic altogether. What was the turning point that allowed her to keep going? What inferences can you draw about the inherent challenges of research inquiry and ways these challenges may be overcome?
- Tyler provides an extensive discussion of her journey with sources. How would you map Tyler’s integration of her source analysis with her synthesis of new information? How does Tyler weigh the potential benefits of a vaccine still in the exploratory/developmental stages against some of the practical challenges involved in the vaccine’s realization?

Are Vaccines the Key to Alzheimer’s Treatment by Myia Tyler

The I-Search project is a great opportunity for me to be able to explore a topic area of interest that I am deeply curious about and connected with. The topic I chose stems from a personal experience in my life that has impacted me significantly: future treatments for Alzheimer’s disease. My grandfather suffered with and eventually passed away from Alzheimer’s disease after ten years. Experiencing my grandfather’s health deteriorate was hard for my entire family, especially my grandma, who, refusing to admit him to a nursing home, became his constant caregiver for the entirety of his sickness. Because I was young when the symptoms first began, I was confused and did not understand what was happening. I quickly caught on however, by listening to our family speak at gatherings, as well as watching my once quick-witted and clever grandfather forget the people he loved most. As heartbreaking as it was, I was able to acquire some knowledge about the disease from hearing family members discuss what they researched about the disease and what the prognosis was for my grandfather’s health.

The older I got, the more curious I became about the science behind the disease. I conducted basic research on my free time to discover information such as the development of Alzheimer's disease, the stages one goes through, the symptoms that occur near death, and some simple facts about Alzheimer's. I focused on the emotional and visual signs and symptoms of the disease, and not as closely on the science concerning Alzheimer's. One topic that drew my family's attention was the fact that Alzheimer's can be passed down genetically and can skip generations, which means it is possible that my brother and I as well as my cousins could develop Alzheimer's as we age. I can't speak for the rest of the members of my family, but when I discovered this information, frankly, it frightened me. I was an observant child and teenager, and I saw the toll caregiving had on my grandmother. I saw the look of desperation, sadness and confusion when my grandpa looked around a room. I saw him lose his ability to remember the woman he was married to for sixty years, forget his three children and seven grandchildren, and his ability walk, talk, and swallow. If it is a strong possibility that I will develop Alzheimer's in my future, I feel pressured to live my life to the fullest. I feel guilty on days I may be emotional or angry because I feel as though I am taking them for granted. I want to experience the most out of my life by traveling and trying things that scare me, so I can appreciate the best things in life while I still can, in case one day I forget them all. The possibility of this disease one day affecting myself as well as my family members is why I am so interested in researching treatment for Alzheimer's. I know my grandpa would not have wanted this to happen to anyone else in our family, and I feel that if treatment or prevention is found and able to be used in future medicine, it would be a way for my grandpa and millions of others who have and currently still suffer from Alzheimer's disease to be avenged in a positive way.

I have wondered about so many things concerning Alzheimer's Disease and have found the answers to a very small portion of my thoughts leading up to this project. I have wondered if this disease can be prevented, what exactly happens in the brain when Alzheimer's begins to develop, and why does loss of brain function begin to happen? I have thought about caregivers and the effect caregiving has on their own health. Does Alzheimer's affect everyone's brain in the same way? How quickly can Alzheimer's take a person's life? Will the growing number of people suffering from Alzheimer's hurt our economy? All of these questions and thoughts have passed through my mind countless times, so it was challenging to narrow my focus as I had so many topics I wished to learn more about.

Being able to research what is currently happening in the medical field concerning prevention and treatment is likely to have a future impact on my family, so from that perspective, I was able to narrow my thought process as to what was most intriguing and personally connected to me. I therefore decided to narrow my question to: What treatments are currently being produced in the medical field to treat and prevent Alzheimer's disease?

I-Search Part II

Initially, I began to conduct my research within several different search engines, including Google Scholar, as well as our library database on campus. However, I received feedback from groupmates as well as Dr. Stearns concerning the broad spectrum that my research focused on. I too realized that looking at treatments of Alzheimer's disease would indeed result in a substantial number of articles and popular media that may be too broad to connect specifically. Coming to terms with the vastness of my topic was my largest setback during the research process, and I even contemplated changing my topic entirely. Before making such a drastic change, however, I

met with reference librarian Daniel Harms, who helped point me in the right direction to continue to collect my research by accessing several useful databases which targeted science and medicine. I now look back on this meeting as the most beneficial resource I accessed during my research process. Reference librarian Harms was able to search for articles to get me thinking, and a result appeared that allowed me to narrow my scope on Alzheimer's Treatment even further.

Indeed, the finding of this article allowed for my project to take a turn for the better by narrowing my focus on vaccine treatment. In the *Journal of Neuroimmunology* I located the article on vaccine development: *Alzheimer's Disease Vaccine Development: A New Strategy Focusing on Immune Modulation* (Dante Marcinani, 2015). This article allowed me to begin my search by looking specifically at vaccines and lead me to further research this topic. Marcinani's article dives into potentially using vaccines to build a protective immunity against the disease that is beginning to exponentially affect a larger number of people each year. In fact, the 40 million people who are affected by Alzheimer's is expected to double by the year 2040. (55) Marcinani stresses in his introduction that it is imperative to find a treatment soon, as this disease is taking an astronomical toll both socially and economically on our country. In fact, Sai Janani Ganesan, a postdoctoral scholar at UCSF supports the statistics Marcinani uses in his article. In her article *How Close are we to a Cure for Alzheimer's?* published by *Forbes*, Ganesan projects Alzheimer's to become the largest public health issue in history. As of 2017, the cost of care was \$259 billion, but the cost is projected to spike to \$1 trillion by the year 2050. (2017) The seriousness of this disease is clear based on the quantitative data provided in each of these articles. Marcinani goes on to suggest that instead of trying to treat individuals with treatment that their body most effectively responds to, a vaccine would be the most practical solution for being able to treat and protect a large number of people. The research that Marcinani discusses involving the trials for the vaccine is correlates to that of two additional popular media website articles both found in *Medical News Today*: *Alzheimer's disease Vaccine Steps Closer with New Study*, (Honor Whiteman, 2016) and *Could Alzheimer's be Prevented with a Vaccine?* (Ana Sandoiu, 2017) Both Sandoiu and Marcinani discuss mouse models of Alzheimer's disease in their articles. Vaccines have proven effective in these mice trials, as they increase antibodies which fight off the detrimental brain disease. The vaccines were able to specifically target beta-amyloid and tau proteins in the brain, which cause a buildup of plaque and also forms tangles, which is the ultimate causation of Alzheimer's disease. The protein breakdown of the beta-amyloid and tau is the causation of the lost nerve connection and nerve death (Whiteman 2016). The combination of these articles allowed for me to get a grasp on the most recent research that is being conducted and where the future of vaccine treatment is headed. Admittedly, problems surface when transitioning from mouse models to human trials.

Although vaccines have proved successful in mice trials, nonetheless, more challenges arise when it comes to preparing for testing these vaccines on humans. Of course, human and mouse brains are biologically different, so while trials may be successful when tested on certain animals, when the same trial is conducted on humans, it often fails or is not as successful. In fact, in a ten-year time span between 2002 and 2012, 413 clinical trials were performed, resulting in 244 compounds that were found to be efficient and safe, which is a 0.4 success rate. (Whiteman 2016) It is also possible that the vaccine may not be completely safe for patients to be exposed to, so it is imperative that more research is conducted before being able to be available to the public.

While it is true that these vaccines need to be developed further before they are able to be distributed as a successful treatment for Alzheimer's disease in the medical community, there is hope that vaccines could be the key to treating Alzheimer's. Sandoiu's findings suggest that a prophylactic vaccination approach could be a viable public health intervention against Alzheimer's disease. (2017) Sandoiu, Marciani, and Whiteman conclude that despite needing a significant amount of work, the fact that the vaccine trial shows success in mice is one step closer to finding a treatment and shows that scientists are on the right track. Additional searching lead me to find the article published by the Journal of Post-Acute and Long-Term Care Medicine: Active Vaccines for Alzheimer's Disease Treatment. (Rosalie Sterner, Paul Takahashi, Aimee Ballard, 2016) Compared to that of Marciani and Whiteman's, Stearner's et. al. conclusion is similarly hopeful. Although failure has outweighed success in the search for a working vaccine, it is likely that a vaccine will be produced and become an effective treatment in the near future. In fact, Whiteman is confident that a vaccine will be available to patients within three to five years, which is very promising for those desperate for treatment. (2017)

After becoming familiar with these five articles, I put into practice the several tactics that I learned by spending two classes with reference librarian Czirr to search for academic sources. I used several search engines to investigate articles, searching through the key words "Alzheimer's Disease," "Treatment," and "Vaccines." I connected all of these keywords by using the Boolean method, which allows for the keywords to be searched using the words "AND, OR, or NOT." I found that using "AND" gave me very specific articles that related to all of my keywords, versus when I used the connectors "OR" and "NOT." I sifted through several of these articles, selecting the ones I believed would contribute most to my research. I also narrowed my results by setting limiting factors to most recently written articles, credible authors and sources, and whether the article was peer reviewed. I was able to save several of these articles by using the Permalink that Czirr showed us in class.

In contrast to the articles I had read initially, these articles that I came across were denser and more complex, and therefore harder to understand. In order to decipher through the medical jargon, I took the advice of reference librarian Daniel Harms when it came to reading through the following articles: Peripheral Anti-A Antibodies Alters CNS and Plasma A Clearance and Decreases Brain A Burden in a Mouse Model of Alzheimer's Disease (Demattos et al., 2001) published by the National Academy of Sciences of the United States of America and Treatment with a Copper—Zinc Chelator Markedly and Rapidly Inhibits -Amyloid Accumulation in Alzheimer's Disease Transgenic Mice (Cherny et al.,2001) published by ScienceDirect. I was able to focus intently on the introduction and conclusion of each of these articles, which allowed for me to determine what the authors planned to discuss, and what they determined based on their findings, while skimming the body paragraphs to get an idea of what the trials included. This way, I was able to clearly understand what I read, without becoming lost in the statistics and names of proteins. Despite these articles being older than the articles previously mentioned, they still contained relevant information involving the use of vaccines to conduct research. Similarly, to the trials from the articles above, both of these trials conducted their experiments with mice. As each article states, they are specifically testing to see if the vaccine injected into the mice will clear the amyloid A peptide that is responsible for creating the plaque build-up in the brain. Getting the vaccine to break up the plaque build-ups however, is the challenge that these scientists face. Known as the "blood brain barrier," only certain molecules are able to enter the brain through our bloodstream and reach these plaque forms to break them apart. (Demattos et

al., 2001) Cherny et al., concluded that in brains of mice that had significant amyloid plaque buildup, after being given the vaccine, there were no traces of the A peptide left within the brain. (2001.) Demattos et al., goes on to say that if one were to add an anti-A peptide, that that antibodies would “serve quickly and efficiently to alter the clearance and effect of biologically active peptides in the brain.” (2001) The vaccines administered in each of the trials were successful enough to complete the goal of destroying what was causing the degeneration of the brain, which leaves scientists on a path leading to a similar vaccine that will be just as successful in humans.

Now that I had studied several scientific perspectives of Alzheimer’s disease, I decided to get a sense of the public knowledge on vaccines used for Alzheimer’s treatment as well as the Kairos of the discourse on my topic. I discovered two popular media articles to get a basic understanding of what is portrayed to the average person involving vaccine treatment for patients with Alzheimer’s. Two results that were conclusive were Top Alzheimer’s Researchers Hope that Near-100 Dementia Drugs in Trials are Moving Closer to a Breakthrough published by CSNBC (Kelly Song, 2018), as well as Precision Vaccine’s article Still Searching for Alzheimer’s Vaccine (Don Hackett, 2017). Song’s informs readers about the 17 percent increase of success among creating vaccines, despite the media conveying to the public that vaccine trials are completely failing. Song emphasizes the words of the scientists developing the vaccine, who are confident in a vaccine soon being able to treat Alzheimer’s and be released to the public. (2018) Song further depicts the trials discussed by Whiteman and Sandiou, stating that the vaccine trials involving mice are making it to the second and third trials, rather than being cast aside and unusable. These vaccines are so successful in fact, that about eight are expected to be put on the market within a few short years. (2018) Unfortunately, the advertising of the failure percentage often steers patients and their families away from wanting to participate in a clinical trial. Ganesan confirms it is true that in the past success was hindered by several factors including slow drug testing, insufficient funding, regulations, and a lack of surrogate biomarkers. (2017) Although Ganesan’s outlook disagrees with the amount of success within these trials, Song counters by remaining hopeful throughout the article that with an increased success rate, more patients will be willing to participate in trials, and that these successes will soon produce a working vaccine. Hackett strengthens the discourse of Song, as three major trials are mentioned, including research at the University of Dundee and Oxford, Vitruvian Biomedical, Inc., and lastly, Peter O’ Donnell Jr. Brain Institute, all with a positive outlook on the treatment of Alzheimer’s disease. The research being conducted by the University of Dundee and Oxford consists of combining a protein found in cucumbers with a tetanus vaccine. Its purpose is to alert the immune system to engage in fighting off the chronic disease. Not only could this vaccine prevent Alzheimer’s, but if still in the early stages, it could reverse the effects. (Hackett, 2017) Both of these articles mirror what the scientific journals inform readers of, but without the effect of the in-depth analysis of trials.

Based on the information provided in several of these articles, it seems likely that the treatment to Alzheimer’s disease through vaccines is on the horizon. Marciani, Whiteman, and Sandoiu all provide sufficient proof that successful trials in mice are leading researchers closer to creating a viable vaccine. Whiteman concludes that a vaccine could be trialed in humans instead of mice within the next three to five years, while Song supports Whiteman, affirming that eight vaccines have the potential to reach the market and be used within the medical field within a short number of years. Meanwhile, Hackett highlights other possibilities of vaccine creation such as using the

proteins similar to those found in cucumbers. The research in these articles reveals that while it may be a few years into the future, vaccines for treating Alzheimer's disease are already significantly successful, and the continuation of current research will only enhance the findings of a vaccine that will treat or prevent Alzheimer's disease.

I-Search Part III

The research that I have conducted to date involving the use of vaccines to treat patients with Alzheimer's disease has been incredibly informative. Before I began this project, I had heard of the possibility of Alzheimer's disease being treated with a vaccine, however I had no idea about the complexities behind the process of creating a vaccine that would effectively treat or stop the progression of Alzheimer's disease. These vaccines are difficult to create, as the vaccine has to target a specific protein to "destroy." Attempting to do this takes hundreds of clinical trials, which most vaccines fail to move on from. Despite the shockingly high failure rates in the past, the rate of success is on the rise. Clinical trials are moving to the second and third stages with certain vaccines, a feat that has not previously been accomplished. This success within these trials means that a working vaccine is projected to be available and on the market within the next few years, which is promising considering the outlook and effect Alzheimer's disease will have if a treatment is not soon found.

I was astonished at the percentage of the affected elderly population who is expected to become sick with Alzheimer's disease. At first glance into research concerning Alzheimer's, younger generations might find it insignificant as it doesn't affect them directly. But on closer inspection, they would find that it is possible their loved ones, parents and grandparents, and eventually themselves are likely to be affected. As discovered in my research, the amount of elderly people affected by this chronic disease is exponentially on the rise. Of course, this will affect the millions of individuals and families living with or caring for loved ones with the disease. This increase means that millions of more people will suffer from and eventually lose their life to this devastating disease if treatment is not soon found. However, it's not only personal families that would be affected. On a larger scale, Alzheimer's disease is growing so rapidly that our public health system as a whole will begin to become severely affected. Not only is Alzheimer's difficult to treat or stop, it is difficult to pay for as well. Care becomes expensive when it involves nursing homes or at-home caregivers, and to think that the total cost will hit the \$1 trillion-dollar mark in just a few decades is hard to imagine. Alzheimer's is a disease growing so rapidly, it will affect everyone across the board. Ultimately, what is at stake here is the future health of our society as well as the cost of our public healthcare system. Whether you are a tax payer, a family member witnessing a loved one suffer with Alzheimer's, or have a chance to develop Alzheimer's yourself, it is imperative that we as a society are aware of the repercussions that this disease delivers.

As I looked back on the research I conducted, I am quite satisfied about the results and information I obtained on vaccines becoming a treatment or preventative measure for Alzheimer's disease. I was able to come away with knowledge of the current stage of vaccines being created for the purpose of treating Alzheimer's disease, how long it will be until a vaccine is expected to be put on the market and effectively treat patients, as well as why it has taken until this point for success to be had in the process of creating a working vaccine. My research concluded information about a vaccine being a strong possibility for future treatment. While conducting my research, however, I had to narrow in on popular media articles rather than

academical journal articles. The popular media I found was more current, as well as easier for me to understand, whereas the journal articles proved difficult to find as well as to read and comprehend. In that sense, it seems in the end that this topic still may have been too large for me to take on in the amount of time I had available at my disposal in order to conduct this research.

Apart from what I learned from the direct research that I conducted, what may be even more important was learning to craft a research paper. Although I may not have found the perfect answer to my question, I discovered that writing a research paper itself requires a substantial amount of work and time. I didn't know going into this project the amount of difficulty I would have discovering sources, selecting reliable articles and sources I wanted to use, and trying to comprehend longer and more complex pieces. Each of these hardships took time to sift through but doing so allowed for me to learn along the way. I was educated on how to access databases specific to my topic, use keywords, and use the Boolean method to narrow the sources available to me. Not only did I learn to use resources online, but also to access sources around me. I found that reaching out to others who are skillful in the area of research is very beneficial to your work, as meeting with a reference librarian allowed for my project to lift off and grasp a solid starting point. If I were to write another research paper in my future, I now know what to expect along with what I can improve on to produce advanced work. The learning experience that writing a research paper provided was a great base and will allow me to expand on the knowledge I have gained about writing research papers and has given me a template to look back on when writing future papers, especially in graduate school. Overall, I am pleased with my growth as both a student and a researcher because of this project.

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