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WHY ARE WE 33RD? A BIOLOGIST'S PERSPECTIVE

**A thesis submitted to
Regis College
The Honors Program
in partial fulfillment of the requirements
for Graduation with Honors**

by

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May 2017

APPROVAL PAGE

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Introduction: Failing to be the Best

What do kindergarten field day, “friendly” games of ping pong, trivia night, and climbing a mountain all have in common? Well, in kindergarten I could throw Frisbees the farthest and jump in potato sacks the quickest, I always win games of ping pong, my team is always the most well-rounded and knowledgeable at trivia night, and I am always the first of my hiking group to summit a mountain. Throughout my life I have always held myself to the expectation that I was the best; my competitive edge drove me to never accept being anywhere but the top of several lists and rankings within my life. I hold myself to exceptional standards and rarely allow myself to fail at being the strongest, the fastest, the smartest, or the kindest. However, as I have grown and matured, I have gained awareness that I cannot be the best in *everything* I do, but I expect to be number one in what I have the means to be the best at.

I not only expect the best out of myself, I also associate establish friendships and relationships with like-minded people and expect the best out of them as well. I like to think that my friend groups are welcoming and kind, my clubs one of the most spirited and invested, the businesses I work for to be reputable and sustainable, the city I live in to have a fun, safe, openhearted culture, and the nation I live in to hold its citizens to the highest of standards, and most importantly help its citizens to live up to said standards. As Americans, we are known for being a large, democratic, developed, and free country that ranks amongst the top 10 in a vast array of worldwide lists such as the most influential, the best place to start a business or locate international headquarters, one of the safest countries in the world, and the top competitors in the world Olympics. Though we may be a well-developed, powerhouse of a country, there is one unsatisfactory ranking that makes me particularly upset and, in all honesty, ashamed.

Thirty-three out of 145. Not the top ten, not even the top 20. Thirty-third place was never awarded in the potato sack race, at trivia night, or in a competition. In my opinion, thirty-third place is irrelevant and almost synonymous with last place. Perhaps others would interpret this kind of ranking differently, but I have a particular embarrassment for being anything but the best, especially in competitions where I know I could do better. So, what exactly are we 33rd in? It is a category that I believe is the most important of them all for a country's people; a category that truly defines a country and how its people take care of themselves and one another. This category is, nutritional health.

Bloomberg Terminal, which is also known as the Bloomberg Professional Service, is a complex, competitive, and cutting edge computerized interface that follows and analyzes trends in data and rapidly supplies its followers with breaking news from across the world. The terminal is primarily focused around financial investment information, communication via messaging and trading, and data encryption to provide high quality and comprehensive capabilities and information to the general public. On Bloomberg's website, I came across an article regarding a list that its developers created, "The Healthiest Countries". According to The Independent, a worldwide news source,

Each country's place was calculated by subtracting their risk score from their health score. The health score is based on factors such as life expectancy from birth and causes of death, while health-risk is based on factors which could impede health such as the proportion of young people who smoke, the number of people with raised cholesterol, and the number of immunizations (Sims, 2015).

The results of this study are based upon the "health score" that was calculated, however the factors that went into the score are unknown.

Though this bit of insight from The Independent gives a general idea of the indicators that were used to come up with a health index in order to rank the countries, the exact data that was used for this study is unclear and un-descriptive. After digging through various news articles and emailing almost every article author and the Bloomberg Terminal itself, I realized that I would not be able to get my hands on the entire data collection that was used. Given this vague set of records with only small clues from Bloomberg and how the exact ranking was generated, I decided to come up with my own explanation as to how it came about in order to answer why we, as a nation, have failed to be awarded with a top place ranking. From Bloomberg's miniscule amount of provided insight, we know that indicators used to generate the health ranking, including smoking, high cholesterol, and immunizations were used, but there ought to be many more factors that influence the overall health of citizens in a country (Sims, 2015). There are hundreds of thousands of possible impacts on health including disease prevalence, availability of doctors and healthcare, ability to obtain clean water and sanitation, education on health, and many others, but I have spent a significant amount of time analyzing American lifestyle to figure out what could potentially be our biggest detrimental lifestyle factor that would knock our ranking down to 33rd place.

Modern Americans have been raised in an era of confusion. Over the last century scientists, researchers, and healthcare providers have had different and conflicting views on what constitutes a healthy lifestyle. In the early 1900's, the American diet was primarily agricultural. Diets were based off what an icebox could hold and were limited by what was readily available. Fish, poultry, meat, vegetables, and bread were most commonly served at the dinner table. Little advancements had been made in industrial food processing during this era, so it was common for families to cook fresh meals with whatever resources may have been available at the time

(O'Connell, 2015). Come 1910, trans-fats were introduced into the American diet and used in various non-perishable food items such as syrups, mayonnaise, Oreos, and Crisco (Allen, 1952). One decade later, around the time of World War I, more and more processed foods became readily available as kitchen appliances became a necessity and families sought after easier and faster meal preparation ⁴. In the late 1920's meals started to be made from canned and frozen goods, condiments were almost necessary for meals to be palatable, and foods such as Velveeta cheese, peanut butter, jelly, and cereals were introduced to Americans (Allen, 1952). I believe that it is during this time, over a century ago, America first started to threaten its ranking of healthiness.

The first McDonald's was introduced in 1937 and Americans seemed to take a liking for fast, convenient, good-tasting, inexpensive food that could quickly feed their families and allowed everyone more time for other commitments, including work and family time (O'Connell, 2015). Once we entered World War II, the American diet changed yet again. Dehydrated and non-perishable foods were more relied on than ever, feeding both citizens and soldiers across seas (O'Connell, 2015). We may have started having bad habits in the early 1900's, but it is during this era that America began to plummet on its downward spiral in the quality of food produced and, most importantly, the quality of American health.

As WWII soldiers returned from war, the American population continued to skyrocket in size and the demand for food started to stress agricultural and industrial food companies. Seeking any resources that could help them to increase crop yield, farmers joined in on the Green Revolution and started to implement advancements such as fertilization, pesticides, machinery, and irrigation into their farming. Manpower started to be replaced by machines while natural growing conditions were altered and enhanced by chemicals that could supposedly mimic, and

improve, nature. As a result, the nutritional value, including the amount of vitamins and minerals within agricultural foods dropped significantly (Pingali, 2012).

The Organic Center is a group based in Boulder, Colorado that strives to educate farmers, shoppers, and researchers with the most up-to-date scientific data regarding organic foods and farming. Dr. Brian Halweil, a member of the Organic Center, expresses great concern regarding the declining quality of crops since the Green Revolution. His review of research points out that by clearing out crop competition, including weeds, insects, and crop diseases, crop yield increases significantly, however the nutritional value of crops tends to decrease (Halweil, 2007). This is supported by a study completed by the Department of Agriculture in 2004 which shows statistically significant declines in the amount of protein, calcium, potassium, iron, vitamin B2, and vitamin C were noted in 43 different crops grown in 1999 as compared to crops grown with less advanced industrialized farming techniques in 1950 (Davis et al., 2004). Though farmers did use chemicals in their fields in the 1950's, Davis et. al compares these crops to those grown in 1999, when much more advanced industrial farming techniques were used to select for crops with maximal yield. As stated by the study, the decline in nutritional content is most likely due to the trade off for increased crop yield, causing a decrease in nutritional content (Davis et al., 2004).

Naysayers argue that the Green Revolution was beneficial, given that it significantly increased crop yield and allowed for more people within our country to be fed (Pingali, 2012). However, as the calorie availability increased, allowing more people to buy agricultural goods at a lower cost, the nutritional value of the food significantly decreased (Davis et al., 2004). The advancements made throughout this industrialization period were extremely important in increasing crop yield to support the growing American population, however more advancements

ought to be used in order to find ways to restore the nutrient-rich nature of food while still ensuring that there is an abundance of crops to feed our nation.

The decline in nutrition did not stop with increasing crop yield. The United States government realized two things: 1. The population was quickly growing and 2. There wasn't enough food to support all of the people. In a financially-driven interest that would support the American population, government subsidies were established to encourage the food industry to produce low-cost high fructose corn syrup to be used as an affordable sugar-substitute in food (Popkin, 2011). Sugar was becoming increasingly expensive due to trade restrictions, while corn was simultaneously becoming less expensive as agricultural techniques were improving.

In the 1970's, knowledge around food chemistry grew as a Japanese chemist, Yoshiyuki Takasaki, came up with a new, efficient method to produce corn syrup (Popkin, 2011, Reshanov, 2012). After this, high fructose corn syrup started being used in nearly every processed food in America, which created endless opportunities for food processors to incorporate the sugar substitute in a vast array of food groups consumed by Americans. The use of high fructose corn syrup started to be implemented in typical beverages, snacks, and desserts across America (O'Connell, 2015). With the profitability of corn syrup, given how quickly and easily it could be made in large amounts, government subsidies started to encourage farmers to focus more on corn yield rather than fruits and vegetables (Fields, 2004).

In the average American supermarket today, nearly 70% of the foods for sale have been processed in some way (Ryssdal, 2013). These foods include meats, cheeses, yogurts, chips, crackers, cereal, the list goes on and on. There are over 5,000 known different chemicals that go into the foods produced in America, forcing most food to decrease in nutritional value and

increase in palatable taste (Ryssdal, 2013). Because all of our foods have become ultra-processed, it is nearly impossible for the citizens to know what is healthy and what it is not.

Growing up as an American, I was taught that the definition of healthy changes with the most recent fad. The facts and figures that we typically rely on are constantly altered, contradictory, and confusing. How are we supposed to know what to follow and how can we attain the healthiest lifestyle possible? In elementary school we were told to abide by a food pyramid that instructed us to eat plenty of grains, some fruits and veggies, a small amount of dairy and meat, and minimal sweets. Then, in 2005, we were taught a new pyramid with similar portions of food, but also instructed us to get a daily dose of physical exercise. In 2011, the pyramid structure of food consumption was altered yet again to “Myplate”, which was a simple design to guide plate portions between fruits, grains, vegetables, proteins, and dairy (USDA Food Pyramid History, 2016). These Americanized suggestions may seem to be helpful, but amongst the various diet plans proposed, it seems that we have all grown confused about how to properly eat. Between low-carb, low-fat, sugar-free, organic, paleo, and gluten-free diets, we as Americans have become lost in a sea of eating regimens that all seem to contradict one another. Who are we to believe and what lifestyle are we supposed to take on in order to be our most healthy?

The statement that Americans are confused regarding the real definition of health can be fully supported when looking at the life expectancy and overall health of American citizens. Sixty-eight percent of Americans are overweight and nearly one third of them are obese (Ogden et al., 2015). If we are such a successful country, why are we becoming so overweight? It seems contradictory that our country, which is capable of such great power, financial growth, and development is so low in the Bloomberg ranking of “The Healthiest Countries”. In my mind,

America's 33rd place is synonymous with the most intelligent, athletic, skilled, and competitive person losing in a potato sack race, Frisbee competition, at trivia night, or summiting a mountain.

After spending the last 4 years of my undergraduate studies dedicating my life to gaining an education in biology, I have come up with my own idea regarding America's lack of performance on the Bloomberg ranking. Given our long history of population growth and financial interests, it only makes sense that our society slowly altered its food dependence from what was grown locally to what is being grown and produced in a factory. Unfortunately, the use of food processing to change the natural state of what we eat, along with an imbalance in our nutritional diets, may together be the exact habits that are forcing our country into being so unhealthy. With a biologist's bias and disappointment in my nation's health, I delve into how what our culture eats and how these habits alter life's most basic, microcosmic component, the cell, leading to a lack of function in the entire macrocosmic human body and society as a whole. In Chapter 1, I map out the complexity of the human body on a cellular level, particularly how cells allow us to grow from infants to adults and sustains longevity over multiple decades. Further exploring the intricate processes that support a human's life, I use chapter 2 to explain the importance of nutrition and the role that our food plays in maintaining a healthy body. If a person tends to provide their body with either the wrong fuels or too many of them, some serious health consequences can be observed, as discussed throughout chapter 3.

Chapter 1: Cellular Complexity

The processes that govern life and allow a human body to grow, live, and reproduce are complex and intricately interwoven. We are built up of cells, tiny and invisible to the naked eye miniature machines that all work together to support our bodies. As we grow and develop the systematic components of our bodies, our cells communicate with one another to allow us to follow typical daily activities such as participating in trivia night, playing ping pong, and climbing mountains. If these cells happen to malfunction, then a body may decline in health, succumb to disease, or possibly die.

So, how do we ensure that our cells function properly while allowing our bodies to grow and be healthy? Our cells go through numerous sets of replication to allow a body to grow into a functioning adult human, and, in my opinion, these processes are quite miraculous. Take for example the growth of a cell immediately after conception. Upon the union of a male and female gamete, a unicellular zygote is created and contains a uniquely recombined copy of its parent cells and their genetic codes. Then, a very quintessential process takes place: mitosis, or the splitting of one cell into two identical cells.

In order for the process of mitosis to occur, one cell begins to grow in size while it duplicates its set of DNA, the unique genetic code within every human cell. Then, it will compactly store its DNA into sister chromatids, which are identical in genetic nature and are connected via a special type of protein, the centromere. The cell will then enter what is called prophase, a step of mitosis that requires the cell to break down its structural nucleolus, a membrane surrounding DNA, and begin to prepare for sister chromatid division by breaking apart at the centromere. Meanwhile, mitotic spindles are formed in order to line the sister chromatids up along the midline of the cell. As the nucleolus, the barrier around the nucleus,

which contains the DNA, is more and more broken down, the cell is able to recognize that is about to enter prometaphase. These various phases of mitosis serve as checkpoints throughout the process. If a cell is not under the proper environmental conditions, which is severely impacted by nutrition, it will not be able to undergo efficient division (Searle et al., 2011).

At prometaphase, the chromosomes have fully compacted all of their DNA in an effort to protect it from degradation or mutation throughout cell division. Suddenly, the nuclear envelope, the final layer of protection around the chromosomes, dissipates and microtubules attached to the mitotic spindle, firmly grasping the chromosomes using a special protein structure called the kinetochore. This tight connection between the mitotic spindle and kinetochore will force the chromosomes to assemble linearly along the metaphase plate, the final organizational step before division begins. At this point, the cell is able to take in signals that will act as reassurance in whether or not it is ready to complete mitosis.

When in a stressful state, such as when proper nutrients are lacking or conditions are unfavorable, such as pH levels or temperature outside of the physiological range, it can be difficult to complete mitosis and create two healthy daughter cells (Miller et al., 1964). If chromosomes are not perfectly lined up and properly attached to microtubules, or if the cell is in some type of stressful environment, the process of mitosis will halt here until whatever the issue-causing situation is solved. Then the cascade of mitotic-events can continue into the next step, anaphase. During anaphase, sister chromatids are forced apart by special motor-like proteins as microtubules pull them toward opposite poles of the cell, causing the cell to uptake a bean-like shape that is round at the ends and thin in the middle. As the chromatids get farther and farther apart, the cell will pinch in near the middle, its spindle fibers will disappear, chromosomes begin relieving their tightly-held tension, and the nuclear membrane and nucleolus starts to reform

within each new half of the cell, which will be daughter cells upon completion of the process. As normal structures start to re-establish themselves within both cell copies, the final step, telophase will occur until the cells pinch apart their cytoplasm and cleave from one another.

Finally, 12-24 hours later, the two new cells will separate and be identical copies of one another, making the unicellular basis of life double (Snustad et al., 2016). In order for mitosis to occur properly, the cell that is splitting must be under proper conditions. If it is an unhealthy environment, such as one that is too acidic or basic, too warm or cold, or poorly nourished, mitosis will not occur. A study completed by researchers in Japan stressed cells in vitro by starving them of nutrients and, as they expected, mitosis arrested (Aiko et al., 2013). Another similar study suggests that cells under nutritional stress, which is induced in vitro, tend to inhibit mitosis in order to avoid damage to the replicating DNA (Searle et al., 2011).

For the first two weeks after conception, mitosis will continue to occur until a small bundle of cells, nearly the size of a small apple seed, settles into the mother's uterus and starts to do something very unique: cell specialization. Before this point in time, all of the cells were duplicating the original unicellular zygote and expressing the same characteristics, but around day 14, the cells will split and half of them will continue to grow into the fetus while the other half specializes as the placenta, providing nutrients for the growing fetus (Reece et al., 2011). However, cell specialization does not stop here. While a fetus grows inside its mother, different cells will start to produce limbs, eyes, ears, teeth, muscles and organs (Reece et al., 2011). Nine months later, the fetus is viable and will continually go through cellular replication, allowing it to eventually grow over several years into an adult.

The processes that allow humans to grow from one cell into a huge mass of specialized cells making up a functional body are complicated and tedious. It seems impossible that all of

our cells could have originated from one ancestral cell, but through many intricate processes, we manage to develop into functional bodies that can walk, talk, think, and eat. Within our initial unicellular being was a large set of genes inherited from our parents. So, what function do genes serve in cell specialization? In theory, all of our cells hold the exact same DNA, meaning that our muscular cells hold the genetic information for eye cells, our liver cells hold the blueprint for making an ear, and skin cells could technically be turned into a bone cell. If every cell throughout our body expresses certain functional and structural characteristics, how could they also hold the DNA necessary to make every other organ or tissue that is also found in the body? The distinction between these functionally different cells is how they express their genes. Within a genome, or entire collection of one's genes, some traits can be turned "on" and others "off". These genes can dictate both the structure and function of cells throughout the body (Bjornson et al., 1999, Snustad et al., 2016). In order for one cell to act as an eye and another to function as a muscle, the correct, specific genes must be expressed. In other words, despite the fact that the cells in our eye could be called "eye cells", they actually contain the genes necessary to build an arm muscle, a liver, a brain, or any other body part of interest, but these genes are turned off and the "eye genes", such as HERC2 and OCA2 are turned on (Cunningham, 2008).

Gene specialization is the process that allows our bodily cells to work like one giant factory all together. It is this process that forces our organs to all serve different purposes in the interest of our own overall health (Snustad et al., 2016). For example, the digestive tract constitutes several different organs, made up of very specific cells, that all must work together in order to absorb nutrients into our bodies. When we eat food, it will initially be broken up in our mouths with an enzyme that can break down major carbohydrates, such as those in potatoes or bread. After swallowing the food, our voluntary actions, such as actively chewing, are no longer

necessary as our digestive tract involuntarily begins to take over and work on digesting our food. First, the chewed up food will travel down the esophagus and through the esophageal sphincter, a junction between the esophagus and stomach. In the stomach, food and liquids start to mix together with acetic acid, which breaks down large protein groups such as those red meats or legumes. After passing through the stomach, food travels into the small intestine where further breakdown of carbohydrates, proteins, and starches occurs. These molecular breakdowns occur with the digestive aid of enzymes coming from the pancreas and liver. Once broken down, the walls of the small intestine begins to absorb the nutrients into the bloodstream, allowing them to be metabolized and delivered throughout the body. Finally, any undigested foods and excess cells of the GI tract lining will be pushed through the large intestine to the rectum, where it will be removed from the body (Hillis, 2014).

Without the genetic backbone being duplicated and placed into every one of our cells we would not have the ability to grow into multicellular beings, and without gene expression, our bodies would not be able to carry out life-sustaining processes such as digestion. The nutrients our bodies gain from digestion are necessary for healthy energy production, growth, and repair of damaged cells (Bjornson et al., 1999). As we plateau in our growth as adults, it is essential that one supports their cellular systems in order to assist these cells in supporting our functional bodies. Whether it be function, duplication, or specialization, cells are constantly upholding necessary tasks to support the body. As adults, our cells no longer spend all of their energy on dividing in the interest of bodily growth, but rather focus more on their important contribution to the body as whole. If cells begin to get worn out, damaged, or die, they will be replaced, but only a limited number of times, given that the production of cells via mitosis slows down significantly once our bodies are done growing in size around adulthood (Reece et al., 2016).

Cells, and particular the DNA within cells, have an expiration date. As a body ages or endures excess stress, cells start to perform their jobs less efficiently. This is most obvious in elderly people, as they start to approach the end of their lifespan and have a harder time completing necessary tasks due to weakness, fatigue, or disease. However, those who live unhealthy lifestyles, particular by poorly fueling their cells with proper nutrients, display similar life-threatening symptoms. The cause of aging is rooted in our DNA. On the end of our genetic sequences are areas called telomeres, regions of DNA that does not code for any genes, but rather acts as a protective cap to DNA, ensuring that the coding sequences of genes are not altered, allowing our bodies to function properly. Each time a cell goes through mitosis, the telomere gets truncated, and after many rounds of mitosis it will become dangerously short, threatening the integrity of our DNA inside of the telomere that encodes for important functional genes. When this happens, that cell will receive a signal that it has duplicated itself too many times, forcing it to commit “cell suicide”, or apoptosis (Reece et al., 2016). As more and more cells go through replication and cut off tiny amounts of their protective telomeres, a body starts to naturally age.

When properly taken care of, cells should be able to undergo replication numerous times, supporting a long, healthy lifestyle. A cross-sectional study completed by researchers for Shaklee, a company that distributes various products for health and weight management, suggests that users who have used their nutritional supplements 4-6 times per week for over 5 years had, on average, telomeres that were 11.2% longer than those in the study who did not take this nutritional supplement (Harley et al., 2014). With this study and the knowledge that telomeres are related to longevity and cellular health, one can assume that the Shaklee nutritional products contain important fuels to support the healthy division of cells. In this study, there was a

wide distribution of data, with an R^2 value of 0.1205 for the control group and 0.0137 for the supplement-using group (Harley et al., 2014). In a linear regression model, two factors, such as telomere length versus age, are compared and relationships and relationships can be established. The R^2 value, or the coefficient of determination, of a linear regression shows how well the data fits to the linear regression extracted from the data. A strong relationship between the independent variable and the dependent variable should have an R^2 value very near 1.00. However, the values in this Shaklee study are very far from 1.00, suggesting that the linear trend of the data is not particularly reliable and able to suggest a definitive conclusion regarding Shaklee use and telomere length. Though the data in the Shaklee study may have unclear correlations, the general trend that the study suggests is interesting. Perhaps if larger, more specific cohorts of people were used for the control and experimental groups, rather than anyone between the ages of 30 and 80 who either did or did not use the supplement, the study could be more reliable and draw definitive conclusions regarding nutritional supplements and telomere length.

Other studies, such as one completed by researchers in Tel Aviv suggest that putting telomeres under different types of stress can either shorten or lengthen them. For example, this study suggests that alcohols, including ethanol, methanol, and isopropanol, all allowed telomeres to maintain their length, while caffeine and high temperature environments resulted in a shortening of telomeres (Romano et al., 2013). Clearly, there are many different factors that play into how well telomeres are maintained in the mitotic cells of the human body. In all, it has been suggested by multiple scientific publications that a well-fueled body is better equipped to sustain a long, healthy lifestyle than one with poor nutrition (Mazidi et al., 2017, Zota et al., 2015,

Leung et al., 2014). When the systems of the body are overworked and poorly cared for, one will start to experience a decline in health, increase in disease, and/or a shortened life span.

In order to keep the body healthy, cells must be in a physiologically supportive environment. The human life begins with one, microscopic, invisible to the human eye, element: the cell. Any biologist would admit that they have been taught, at some time or another, “cells are the building blocks of life”. Starting as one cell, we go through mitosis an innumerable number of times until we develop from nonspecific, unicellular entities into large, intricate, highly complex masses made up of over 37 trillion specialized cells. Being adults, we must always remember that we are living within a body made up a finite number of cells. As our cells age, our bodies age and we approach the end of our lives. Given this daunting reality, we must remind ourselves that we ought to take any and all necessary precautions in order to keep our bodies healthy and ensure that cellular growth and maintenance does not get stunted by any external factors, especially those that we can control independently.

To properly function, every cell, regardless of its job, ought to be well nourished. If a cell has too much or too little nourishment, it will find itself incapable of upholding the demanding duties it completes day in and day out to support our well-being. Though one cell may seem negligible, every single cell within our bodies upholds a hugely important function that we could not survive without. Clearly, the cells that make up our bodies are incredibly efficient in how they all function together to make up an entire human body. These cells have various important needs to properly function, one of the most important being nutritional fuel.

Chapter 2: Nutritional Inundation

In order to climb mountains, answer trivia questions, and even sleep, the body needs fuel. There are several metabolic processes that take place allowing one to consume foods that get broken down into their most basic forms, allowing all of the nutrients consumed to be used as fuel and converted to energy, supporting human life. Nutrients can be defined as a supply of substances that are required by cells and bodily systems for growth and maintenance. Macronutrients are those that are needed in very large amounts, while micronutrients, such as vitamins and minerals, are those that are quintessential for well-being, yet are needed in a much smaller amount. When feeling hungry, the body is trying to signal that it wants more food to break down and use for energy. Fuels are hugely important and are the basis of livelihood, allowing cells to create energy, complete their necessary functions and tasks, build necessary molecules, detoxify the body, and keep the body warm (Lieberman et al., 2009).

The most important nutrients that support these cellular processes include proteins, carbohydrates, and fats, each of which are macromolecules. Micronutrients, particularly vitamins and minerals, also serve important functions, on a smaller scale, in many cellular processes. According to the World Health Organization (WHO), a healthy diet is composed of fruits, vegetables, legumes, nuts, and whole grains. In order to strike a proper balance between these fuels, it is important that a person eats enough of each type of nutrient in order to support their body. The World Health Organization suggests that an adult eat at least 400 grams of fruits and vegetables daily. For reference, the average apple is nearly 100 grams, a cucumber is around 300 grams, a carrot is around 50 grams, and 20 grapes are around 80 grams. By combining together different fruits and vegetables throughout the day, 400 g of these foods can easily be ingested. Assuming that the average person eats around 2,000 calories per day, the WHO suggests that a

maximum of 10% of a person's intake come from sugars such as those found in juices, syrups, cookies, and honey. Thirty percent of calories should come from fats, such as olive oil, fish, nuts, and avocado. Other fats, such as those in meat, butter, and cheese, should be avoided or eaten in very small amounts to ensure that the body be supplied with "good" fats over the bad. By eating a healthy meal, the WHO claims that non-communicable diseases, such as diabetes, heart diseases, blood clotting, and cancer can be avoided. With a more healthy diet, we will be able to live more long-term, healthy lives (Healthy Diet Fact Sheet, 2015).

Several very complicated processes take place when eating a meal. I will start by providing an example of how an average, well-balanced meal gets metabolized in the bodies to provide energy. For the purpose of this example, it can be assumed that the meal being eaten includes protein-rich chicken with carbohydrate-filled toast and fatty acid-rich avocado. These carbohydrates, fatty acids, and proteins all serve hugely important tasks in the body, but in order to be functional, they must be broken down from their large, complex structures into simplistic, smaller components. Carbohydrates are all broken down into glucose, a six-carbon chain that includes oxygen, hydrogen, and carbon atoms (Lieberman et al., 2015). These three types of atoms are where the energy within glucose is stored, and when the bonds between them are rearranged, modified, and broken, energy can be released. Fatty acids are primarily made up of hydrophobic, or water-fearing, chains of carbons and hydrogens, but the head of a fatty acid contains oxygen, allowing this portion of the molecule to be hydrophilic, or water loving. Upon eating fatty acids, such as those in the olive oil, the fatty acid, hydrophobic, chain and the glycerol, hydrophilic head, are separated from one another and used for cell structure, transporting molecules throughout the body, or stored as energy for later use. Protein-rich chicken is filled with an abundance of amino acids, which are hugely important in the structure

and function of not only cells, but the entire human body. By breaking down all of these molecules in chicken, toast, and avocado, energy can be released and used in various aspects throughout the body.

Protein-rich chicken gets broken down into amino acids and transported to the muscles and tissues for both growth and repair. Without proteins in the diet, the body would not be able to grow muscle mass or necessary tissues for organs and other bodily components. Protein is often referred to as “the building block of life” because without it cells could not repair, synthesize, or replicate genetic information. Amino acids also make up enzymes for catalyzed reactions, hemoglobin in red blood cells, myoglobin in muscles, bone cells to support the body’s structure, hormones to send chemical messages throughout the body, antibodies for immunologic defense, and keratin to form hair and nails (Lieberman et al., 2015). Without proteins, the body would not be able to grow into adulthood, cells could not be repaired and replaced after an injury; weightlifters would not gain muscle mass, hair would not grow, and bones would be weak and brittle. However, like all other nutrients and sources of fuel, when too much protein is eaten, it can be synthesized into fat and stored in the adipose tissue, saved for a later time when the body may need the energy (Lieberman et al., 2015).

After eating starchy bread, carbohydrates are converted to glucose for further energy synthesis and use throughout the body. When carbohydrates first get digested, they will be broken down in the mouth by salivary amylase, an enzyme that specializes in the initial breakdown of macromolecular carbohydrates. After traveling through the stomach, where it will be further broken down by the acidic environment present, these carbohydrates reach the liver (Eberle et al., 2000). Here, the carbohydrates, which have been broken down into glucose, a simple 6-carbon carbohydrate, are sent from the liver throughout the body, particularly to the

brain, tissues, and muscles. In these parts of the body, glucose is further broken down into three-carbon chains and goes through many different enzyme-catalyzed structural changes until it produces ATP, or adenosine triphosphate, an energy-rich molecule. Within the extremely strong bonds of ATP, there is an immense amount potential energy. In order to release this energy and make it usable, the ATP bonds must be broken by enzymes during a hydrolytic reaction. ATP is used for all processes, both voluntary, such as running in a potato sack race, and involuntary, such as the heart pumping blood throughout the body.

If too much glucose is consumed and the cells within the liver, tissue, muscle, and brain are inundated with it, excess amounts will be stored away in the liver and tissues as a molecule called glycogen (Eberle et al., 2000). Glycogen can be thought of as the “backup” supply of nutrients that bodies store away for later use. This way, even if one has not eaten, their body will have this short-term backup stock of energy readily available for use. When there is even more excess glucose and glycogen stores have been filled to their capacity, it will be directly stored in the adipose tissue, or fat on the human body. This tissue accrues fat cells where energy is stored away for use when a body is starving for energy, which typically occurs during rigorous exercise or after not eating for 2-3 days. If one were to overeat or fail to burn off a meal’s calories and have overloaded their glycogen stores, the extra energy will be kept in the adipose for future use (Eberle et al., 2015).

Fats have a similar, yet slightly different fate in the human body after being eaten. Upon entering the body, fats can be used for energy, but not as easily as glucose, hence why it is important to eat a balanced meal composed of the proper nutritional components at specific ratios. Fats are most often used to build or repair cellular membranes, to package hormones or vitamins, and to protect various precious tissues throughout the body, such as those wrapped

around the brain and nerve cells. However, like glucose and protein, too much fat in a diet can be detrimental. When too many fats have been eaten, they will be stored directly in the adipose tissue, similar to other macromolecules (Lieberman et al., 2015).

When speaking about the diet, “fats” is a very generalized term with some important discrepancies that ought to be understood. Not all fats are good for the body, but some are hugely important and others are neutral in regards to health. Saturated fats are found in foods like butter, margarine, red meats, and dairy products. Because these fats are hydrophobic and tend to clump up together into a solid at room temperature, they are not easy to digest and typically flow into the bloodstream. Some have stated that by eating too many saturated fats, cholesterol levels can increase and potentially lead to various diseases such as hyperlipidemia or hypertension (Lieberman et al., 2015). However, research has been published, stating that saturated fats have a very small influence on the body and may even raise high density lipoprotein (HDL) levels, which are the “good cholesterol” and change the dense, small forms of low density lipoproteins (LDL) into larger, less dense LDL, which has been shown to be benign as compared to small LDL molecules (Dreon et al., 1998). Though this may be true, Jon White, an editor at *New Scientist* in the UK, reviews the work done by Susan Jebb, a nutritionist, Jeremy Pearson, a vascular biologist, and Walter Willett, a professor of public health at Harvard University, and concludes that there are far too many factors to take into consideration before defining saturated fats as good or bad. In conclusion, he notes that a healthy diet does not need to completely exclude certain foods over others, but rather a healthy diet should maintain a balance between foods groups and not over eat any types of food (White, 2014).

Though the health of saturated fats is controversial, trans fats are well understood and are known to be unhealthy. The fatty acid chains within trans fats are “kinked” in a way, which is

rarely caused by nature and is most commonly a result of manufacturing foods like partially hydrogenated oils. In the production of trans fats, hydrogen atoms are added to vegetable oils, changing the fatty acid's chemical structure and making them solid at room temperature and able to have a longer shelf life (Bhardwaj et al., 2016). The change in chemical structure of trans fats is the root cause as to why this type of fat is unhealthy. Trans fats tend to increase LDL cholesterol, which is dangerous within a body, and does not alter the amount of HDL cholesterol, which is thought to be more healthy for a body (Mozaffarian et al., 2009). In result, this can lead to an increased risk of coronary heart disease.

Trans fats are known to be detrimental to health and the health of saturated fats is subject of debate. However, it is still important to eat “good fats”, such as plant based oils, avocados, fish, nuts, and seeds. These fats are hugely important in a diet because, unlike trans and saturated fats, good fats, which are typically unsaturated, monounsaturated, and polyunsaturated, serve beneficial roles within the body, such as in protection of the brain and nerve cells and cellular membrane support (Lieberman et al., 2015). The avocado being consumed in the hypothetical chicken meal is deemed a “good fat” because it is monounsaturated in nature, allowing it to be put to beneficial use within the body.

Fats are the very molecules that make up the membranes of many cells and organelles. The plasma membrane of human cells, is made up of a phospholipid bilayer, which is two lipid layers facing one another with the hydrophobic tails on the inside and the hydrophilic heads on the outside. By eating fats, cells are able to maintain healthy membranes and the body can synthesize energetic reactions, process and transport nutrients, and contribute to hormonal responses.

Clearly, carbohydrates, proteins, and fats are all important in a balanced diet.

Carbohydrates are necessary for energy production to support the many processes that take place within the body. Proteins, which allow our bones and muscles to grow and have strength, are necessary nutrients to repair and replace any type of human bodily cell. Fats, though some are good and others are bad, aid in energy production and hormonal signalling. Without a balance between each of these nutrients, the human body would struggle to live a healthy life.

As the body starts to use up available fuels from a meal, it will slowly enter into the fasting state, which occurs after the body is done absorbing nutrients that were consumed from the intestine. This state most commonly occurs about 2-4 hours after eating a meal, once all of the eaten food is digested (Lieberman et al., 2015). At this time point, when the body is in need of energy, it will not have glucose, fats, and proteins as fuels that are readily available to be broken down into energy. Thankfully, the body, as mentioned before, prepares itself for this state with glycogen stores within muscles, tissues, and the liver. When no fuel is left to be digested, glucagon, a hormone signalling glycogen breakdown, is released and the hormones that aid in digestion of eaten fuel are inhibited. This allows the breakdown of glucose stores in order to produce ATP for energy. However, this storage is extremely limited and can easily be depleted depending on how much exertion the body is under. For example, a bicyclist most commonly uses up their entire glycogen stores to get them through a race lasting multiple hours, while a person staying stagnant on their couch may take over a day of being in an unfed state to use up their glycogen stores (Ivy, 1991).

When glycogen stores are depleted, the body will start to rely on its adipose tissue stores of fat, where excess fuels are stored for long-term. The fats in this tissue can be broken down and used to synthesize energy within the body. If a person continues to not consume necessary

macromolecules for several days on end, their body will continually use up the adipose tissue until it eventually runs out of fat cells to break down (Lieberman et al., 2015). An average person could survive off of these stores for at least a few weeks without being fed, however the exact length of time is entirely dependent on one's body weight, fat to muscle ratio, genetics, and metabolism.

The human body is built to always have plenty of stored energy to support a life for weeks on end without food. This ability and life-sustaining system dates back to our ancestors who would have to forage and hunt for their next meal, making them vulnerable to succumbing to starvation. In order to avoid such a detrimental state, the human body has adapted to store energy in a form that could be used up when fuels were scarce, but physical work, such as walking long distances, hunting, scavenging, and caring for a family and tribe were necessary. It wasn't until food was industrialized that people, particularly Americans, became fully confident that they would have another meal every day; no longer was food availability primarily determined by agriculture, farming, and meats. Historically, humans had to plan out their food sources and relied on hope that they could grow plentiful crops and raise enough animals to provide food for their families, but as the Industrial Revolution developed new machine-dependent food production methods, food security became a norm for most in the United States (Leonard et al., 2015).

Though having food readily available at all times is something to be very thankful for, Americans have abused this luxury throughout the last century and have started to have the opposite problem of starvation. Instead of being concerned about having enough food, our nation has developed the ability to basically eat whenever we want and however much we desire. This development over the century has, of course, been beneficial, aiding in fuel consumption and

making food sources more reliable, but instead of using it to the advantage of living healthy, fueled lives, U.S. citizens have started to step out of vulnerability to starvation and step in to into vulnerability to obesity.

Obesity has become a worldwide epidemic throughout most developed nations, but perhaps most robustly in the U.S., children, adults, and the elderly alike are all overeating and gaining weight. Because citizens have been exposed to an endless amount of food options, it seems almost obvious as to how Americans have become such large-bodied people. Anywhere throughout the nation, there are plentiful resources for food. Grocery store shelves are overfilled with sugar-rich foods and most streets have an overwhelming amount of fast food options. Food may be affordable and easy to access, but since food production has started to rely on processing foods in order to increase output, it seems that the nutritional quality of food has taken a hit. One may think that all food sold at the grocery store is healthy, but nearly 70% of this food found here has processed, or altered from its natural form in some way (Sanger-Katz, 2016). This includes all types of average foods that one would not even think would need added sugar, including breads, yogurts, cereals, condiments, pasta sauce, frozen fruits, and even milks, cheeses, and canned goods. These foods are altered by pumping excess amounts of sugars and salts into them in order to make them taste better than they naturally would (Sanger-Katz, 2016). By doing this, American food suddenly became even more unhealthy than it already was. For example, all-natural peanut butter made of ground up peanuts is innately made up of “good fats”, those that are beneficial for plasma membranes, transporting hormones, and building protective layers around nerve cells when inside the body. However, companies have instead started to process peanut butter and add extra sugar and oil, making the spread more palatable, but more unhealthy (Ryssdal, 2013).

Dr. Mark Hyman, MD is a well-known family physician, educator, best-selling author, and advocate for enhancing American health based out of the Cleveland Clinic Center for Functional Medicine. He states, “You have a whole industry of low fat foods which has then resulted in people’s increase consumption of refined carbohydrates and added sugars. And, in fact, it is very clear that this is the number one public enemy in the western diet. We’re consuming too much sugar” (Hyman, 2016). If all foods have sugars added to them, people will overeat the necessary amount of carbohydrate fuels much more quickly, overloading their bodies with potential energy and forcing energy-inundated cells to reject extra glucose. As the excess glucose is turned away from cells, it will accumulate in adipose tissues, which will continually grow in size as the body gains more weight.

Though starvation is a global problem, I would argue that the opposite is the problem for most Americans. The real problem in this country is overeating, forcing bodies into an inundated state of fuels, which drives them to store away the excess fuels as fat cells for “future” use, a stowaway that seems to rarely be needed by many. A Youtube user, SW Yoon at the Ritsumeikan Asia Pacific University asked many of his international peers around campus what they first thought of when thinking about Americans. In the video, nearly every participant pointed out that we are, on average, a society made up of people with very large, sometimes obese, bodies. Other commenters also pointed out that we seem to be a content, wealthy, funny, and jolly society, but nearly everyone, whether they were from Germany, Japan, Kenya, Honduras, Sweden, and Norway all agreed that we are a country of overweight people (Stern, 2016). This video not only caught my eye, but made me realize just how obvious our lack of health is to not only myself, but even to people across the world.

Being a world-renowned country with so much power and influence on the global world makes it shameful that America has become so well known for being so unhealthy and overweight. In my opinion, it is embarrassing that we are 33rd on the world's health ranking and something that we as a country ought to be embarrassed of. Though there are many factors that can lead into a country being unhealthy, the number one issue, from my perspective, is that our bodily cells are inundated with far too many fuels. With such an unnecessary amount of fuels being pumped into bodies, it is obvious that we as Americans have created the problem ourselves. Though our bodies have the ability to store energy, we now suffer the consequences of too much energy storage in the form of fat. If something does not change and Americans continue to overeat, bodies will continue to overgrow in their fuel stores, which will likely never be used up, making our American society continue to grow in bodily size, and, subsequently, in its severity of unhealthiness.

Chapter 3: The Detrimental Outcomes of Obesity

Though they are often used interchangeably, there is a distinct difference between being overweight and obese. Typically, these values are measured by calculating one's BMI, or Body Mass Index, which is computed by taking into account a patient's height, weight, and age. Adults are considered healthy when their BMI is between 18.5 and 25, suggesting that they are neither underweight nor carrying too much weight for their body structure. BMI values between 25 and 30 are considered overweight, though this value can often be misleading, seeing as people with excess muscle tissue often have a high BMI, despite the fact that they may have a lean, strong body. However, once a BMI exceeds 30, a patient is no longer overweight, but rather obese. (Overweight and Obesity Statistics, 2012). Obesity is a condition when a person becomes grossly overweight by having an excess amount of fat stored in their body (Defining adult overweight and Obesity, 2016). Though this condition can be caused by various factors such as genetics and a lack of physical exercise, it is most commonly caused, in the United States especially, by a poor diet and overeating (Defining adult overweight and Obesity, 2016). In America, 2 out of 3 adults are overweight, while 35.7% of adults ages 20 and older are obese. (Overweight and Obesity Statistics, 2012).

Having excess fuel stored as fat tissue within the body can lead to a detrimental state of being that affects nearly 1/3 of Americans, making them so severely overweight that they become obese. American citizens are obese and this excess fatty tissue is all rooted, for the most part, in our diets. The more foods, particularly sugars, a person eats, the more fatty tissues they develop and store. As more and more fat is stored, a person will continue to gain weight, which is extremely dangerous for one's health. Often one of the first signs of overeating over a long period of time is weight gain. Obesity is a condition when a person becomes grossly overweight

by having an excess amount of fat stored in their body (Defining adult overweight and Obesity, 2016).

Beyond lethargy and difficulty completing daily tasks due to having so much excess weight, those who suffer from obesity are in a very vulnerable state and can easily succumb to many other diseases. Most commonly, obesity acts as a precursor to other life-threatening illnesses such as type 2 diabetes, heart disease, blood clots, strokes, fatty liver disease, depression, anxiety, and various cancers including that of the breast, colon, uterine lining, and kidney disease (What are the Health Risks of Overweight and Obesity?, 2012).

Weakness and Fatigue

Those carrying more weight than they ought to commonly experience various types of bodily aches, pains, and discomforts. As previously stated, those who are obese are bearing more weight, particularly on their joints, making them feel more exhausted, weak, and fatigued than a healthy person (Jarosz et al., 2014, Cavuoto et al., 2014). This is most commonly due to the need for excess energy for their body to support itself. As discussed earlier, a body needs to use its nutrients to produce energy, or ATP, allowing various bodily functions to take place. On a cellular level, fuels are used to produce energy and power, allowing muscles and tissues to complete their necessary functions.

Muscle cells are much less efficient in using energy to move a body when they are forced to carry more weight than they are designed to do. A study completed by researchers at the National Center for Genome Resources used several databases to analyze metabolic data of obese people and better understand the biochemical nature of obesity. Results suggest that those who are obese typically have a certain inhibition of one of the steps in the Citric Acid Cycle,

which is hugely important in developing ATP. Because ATP is not made as efficiently at this step, people tend to feel less energetic, have an increased appetite, and decreased physical activity, all of which are caused by a decrease in the amount of ATP that is produced from consumed foods. (Wlodek, 2003). This lack of energy is directly caused by a person's cellular level of energy production in their cells, making them feel weaker (Wlodek, 2003).

Though carrying an excess of body weight can be stressful for a body, resulting in fatigue and weakness, these symptoms are also rooted in the many diseases that being overweight is a precursor to, such as diabetes, heart disease, arthritis, and sleep apnea. In all, the best way to avoid all of these diseases and relieve their associated symptoms is to lose weight, lessening the stress impact throughout the entire body.

Diabetes

Type 2 Diabetes is a disease in which the body is unable to properly metabolize sugars for energy. In a healthy body, a person will eat sugars, such as a slice of bread, to fuel their body with glucose. Upon recognizing the presence of glucose, the pancreas, an organ in the abdomen responsible for aiding in digestive processes, secretes a hormone called insulin, which sends a signal to bodily cells instructing them to take up the glucose and use it for energy (Type 2 Diabetes, 2016). A healthy person's cells would receive this signal and allow specialized channels to bring glucose into the cell, allowing it to go through further metabolic processes to synthesize energy. However, a patient suffering type 2 Diabetes has inundated their body with glucose over many years and has developed resistance to insulin. (Type 2 Diabetes, 2016). With this resistance, the cells within the body do not properly respond to insulin secretion and basically ignore the signal, preventing cells from taking in glucose. Without the glucose, cells,

such as those in muscles and tissues throughout the body, are not able to metabolize the sugar and create energy. Because the cells do not uptake the glucose, the body will now be under a condition called hyperglycemia, meaning that there is too much sugar freely floating in the blood.

Ten years ago, only about 5% of Americans suffered from this disease, however, today, over 10% of the American population is diabetic (Type 2 Diabetes, 2016, Diabetes in the United States, 2016). Research has suggested that 85% of patients in the UK suffering from type 2 Diabetes are also obese, suggesting that there is indeed a positive correlation between being obese and succumbing to diabetes (Diabetes and Obesity, 2015). Treatments for this disease often include lifestyle changes, such as diet monitoring and weight loss, following a strict prescription regimen, monitoring blood sugars, and most recently, gastric bypass surgery.

Gastric bypass surgery is a procedure done to alter the gastrointestinal tract, limiting the amount of food that comes in contact with the stomach and can be digested. The STAMPEDE study (Surgical Therapy And Medications Potentially Eradicate Diabetes Efficiently) was started by gastroenterologists at the Cleveland Clinic to observe the longstanding effects of gastric bypass surgery on patients with diabetes. In order to complete this study, physicians created 3 groups to observe and compare over a four year period after surgeries were initially completed. One group was only treated with lifestyle changes and medications, another with the Laparoscopic Sleeve Gastrectomy along with lifestyle changes and medications, while the last group was treated with Roux-en-Y Gastric Bypass surgery and lifestyle changes and medications. Many publications regarding this study have suggested that bariatric surgery aids in better management of diabetes both with and without medication, however other studies point out the risks, complications and possible failures of the tactic at treating diabetes.

The study has promising results, given that it has shown nearly 90% of patients that underwent surgery had an easier time maintaining healthy blood glucose levels without using medications such as insulin. Reassuring results also point out that typically, only 5% of diabetic patients are able to have longstanding, well-controlled blood glucose levels when treated with medications alone, however nearly 30% of patients on medications after having the bypass surgery were able to control their sugars and avoid hyperglycemia after surgery. Finally, patients who had the surgery and significantly greater weight loss than those who did not undergo bariatric surgery. Furthermore, it was suggested that those who lost more weight were more capable of controlling their blood glucose levels, thus allowing them to have a better control on their health. , (Al Suwaidi, 2014), (Hoyle, 2014). Researchers from outside the Cleveland Clinic have also noted success following gastric bypass surgery. For example, Pournaras et al., (2010) noted a significant increase in insulin production and a decrease in insulin resistance, allowing the body to better respond to glucose intake.

Though the results of this study are promising, other researchers have expanded upon it and suggest potential flaws in the study. For example, researchers at the University of Miami completed a study looking at the short term effects after Roux-en-Y gastric bypass surgery. Their results suggested that the operation was most beneficial for patients who were young, had few diabetic complications, had little family history of diabetes, did not rely on insulin, and had a larger postoperative weight loss showed reassuring results. On the other hand, those who did not fit into these characterizing groups tended to have a significantly shorter remission period of diabetes and its symptoms. (Iacobellis et al., 2015). However, in order to combat these complications, researchers have created a scoring system, the ABCD as a multidimensional grading system to estimate whether or not the treatment will be successful for diabetic patients,

guiding patients and physicians to seek out the best treatment for each patient based on their individual situation (Lee et al., 2015).

In all, diabetes is a growing disease in America and the STAMPEDE study along with associated research has started to suggest promising ways in eventually treating, and perhaps even reversing the pathology of diabetes. Because, in essence, bypass surgery forces a patient to limit what they eat and how much fuel their body is able to digest, it is clear that there is a relationship between overeating and succumbing to diabetes. As more research is completed and individualized predictor models are developed, there is potential for physicians and patients to work out individualized treatment plans that either help them to better manage their diabetes, or perhaps entirely cure it.

Heart Disease

Heart disease is a very broad term that relates to many types of heart conditions. These conditions can include, and are not limited to disease with the blood vessels thickening and hardening, such as coronary artery disease, heart rhythm issues, particularly arrhythmias, and heart defects that can begin when a patient is an infant, such as congenital heart defects. (Mayo Clinic Staff, 2016). Blood cells circulate throughout the body to deliver oxygen throughout the body. In order to travel throughout veins and arteries, the heart pumps blood with a natural rhythm and a standard pace, driven by electrical signals that cause the constriction of heart muscles (What are the Health Risks of Overweight and Obesity?, 2012). However, as a person gains weight, their heart becomes responsible for pumping a higher volume of blood throughout the body, which is much more work than it was made to do. This stress on the walls of bodily

arteries, or the channels through which oxygen-rich blood travels throughout the blood, can lead to hypertension, coronary heart disease, and heart failure.

Hypertension, commonly known as high blood pressure, is a stressful condition for the heart because it cannot efficiently pump blood cells throughout the body, providing tissue and muscle cells with necessary fuels (DeMarco et al. 2014). Studies have suggested that roughly 75% of men and 65% of women with hypertension are also overweight or obese (Obesity and Hypertension: Two Epidemics Or One?, 2004).

Coronary artery disease (CAD) is a condition where a patient fails to eat well, exercise, and maintain a healthy body weight, making them most vulnerable to succumbing to this disease. Typically, after failing to follow proper lifestyle choices, the coronary arteries become blocked by fatty deposits and build up wax-like plaque on their walls (Coronary heart disease). At first, this condition may be asymptomatic, but over time a patient typically starts to experience chest pain, shortness of breath, and even heart attacks or blood clots. (What is coronary heart disease?, 2016). Each year, nearly 610,000 people die in the United States from coronary artery disease, making this condition the leading cause of death in our country for adults ages 35 and older (Coronary heart disease). Given that one of the largest risk factors for developing CAD is being overweight, there is a definite potential that Americans could decrease this disease prevalence and live longer, healthy lives.

Congestive heart failure (CHF), another form of heart disease, is similar and often occurs with other forms of heart disease, including hypertension and coronary artery disease. Some may assume that this condition means that a heart is failing and no longer working all together, however, it is a weakening of the heart muscles, causing the heart to have a difficult time pumping oxygen and nutrient rich blood throughout the body. As stated before, red blood cells

are hugely important in supplying the cells in muscles and tissues throughout the body with the fuels they need to survive. If the heart muscles are being weakened, then these red blood cells do not travel as efficiently as they should throughout the body, forcing the heart to work even harder. CHF is typically diagnosed when a physician notices enlarged chambers of the heart on a chest X-ray(What is Heart Failure?, 2016). The chambers increase in size so that more blood can be gathered there, and constrict harder than normal, allowing the heart to output as much blood as a healthy heart would. In an attempt to reverse symptoms, particularly increased blood pressure, the heart will start to accumulate more muscle cells, allowing it have a stronger ability to constrict and pump blood, however this only helps to remedy the symptoms for a short period of time (What is Heart Failure?, 2016). The heart will also try to pump faster than normal, allowing more blood to circulate throughout the body. The heart takes these measures in order to increase blood flow, however they are only temporary fixes. Overtime, the heart will continue to become more and more weak and the patient will succumb to more severe symptoms including generalized fatigue, chest pain, and shortness of breath (What is Heart Failure?, 2016). One of the best ways to avoid this disease is to keep the heart healthy, particularly by keeping the body at a healthy weight to ensure that heart doesn't have to overwork itself to provide blood throughout the body.

Clearly, being obese is an extremely dangerous condition that can lead to multiple cardiac issues. Diseases that fall under the umbrella term of "heart disease" are all most commonly caused by certain lifestyle conditions, particularly being overweight. As a body continues to gain more and more weight, it will have to work harder throughout. One of the organs that is most affected by this is the heart. Given that the heart is arguably one of the most important organs in the body as it supplies muscles, tissues, and other organs with nutrients and oxygen, it is very

dangerous to put this organ under stressful conditions. By maintaining a healthy weight and eating properly, a body will be less vulnerable to developing cardiac diseases, allowing that person to live a much more healthy life.

Arthritis

When a body is extremely overweight, muscles and bones are under a more severe level of strain. By forcing these parts of the body to endure more weight, a patient's joints typically start to feel pain and discomfort. Joints are the parts of the body where different bones come together, like in the knees, hips, shoulders, wrists, ankles, and elbows. Weight bearing joints, or joints that carry the majority of bodily weight, include ankles, knees, and hips, making them more vulnerable to succumbing to deterioration over time when carrying excess weight. People who are overweight are 60% more likely to developing osteoarthritis, or deterioration of their joints, which causes joint pain (Jacques, 2014). Having joint pain is very common for a person who is overweight, especially in their weight bearing joints, because they have forced these areas of the body to support more weight than they are intended to. The best way to treat symptoms like this include losing weight and strengthening muscles, allowing these joints the ability to more efficiently hold up body weight. In a study funded by the US Department of Veteran Affairs, the impact of weight loss on joint pain was observed over a year long randomized controlled trial. Results suggest that losing a significant amount of weight, defined by any amount greater than 5% of the patient's body weight, a patient reported significant decrease in their arthritic pain. However, patients who did not lose as much still had a similar severity of pain (Mashab et al., 2015). Clearly, By carrying less weight and building stronger muscles,

weight bearing joints will undergo a significantly less amount of pain, helping the [KC1] patient to feel less arthritic pain.

A study completed by researchers at Brigham and Women's Hospital and Harvard Medical School show a significant decrease in arthritis symptoms after obese patients underwent gastric bypass surgery and lost body weight. (Sparks et al., 2015). As the study explains, it is probable that once patients start to lose weight after bariatric surgery, their joints experience a decrease in arthritic pain given the decrease in weight they are forced to bear. Another study completed by Canadian researchers supports the claim that weight loss and increasing physical strength both play an important role in decreasing one's suffering caused by arthritis (O'Donnell et al., 2013). Though bariatric surgery or diet and exercise are specifically focused on helping a patient to lose weight, these activities have secondary effects by relieving the body's joints from carrying excess, thus decreasing the severity of joint arthritis.

Sleep Apnea

Patients that are obese often complain of feeling weak and fatigued, however, perhaps unexpectedly, it is common for those who are obese to have difficulty sleeping at night. (Contreras, 2014). With excess body weight pressing down on them, soft tissues in the oral cavity and throat have a tendency to relax, obstructing the airway. Though this relaxation of the airway tissues and muscles can happen while awake, patients typically suffer from these symptoms while sleeping, when the body is relaxed. With the airway obstructed, breathing becomes much more difficult and uncomfortable, forcing a person to wake up out of sleep. (What is Sleep Apnea?, 2012). Typically, sleep apnea causes a person to snore loudly, yet at its most severe state it can cause an entire cessation of breathing. Having so many episodes of

waking up throughout the night makes one's sleep much less restorative than it should be, thus making them feel more tired throughout the day, have intermittent headaches, and experience moodiness (Heit, 2008).

The most accepted cause of sleep apnea is a patient's excess weight making their tonsils and tongue enlarged, forcing their neck circumference to be larger than normal. A study completed by researchers in the Respiriology Department at the University of Ottawa suggest that a patient with a larger neck circumference, greater than 17 inches for men and 16 inches for women, are significantly more susceptible to having sleep apnea (Katz et al., 2015). Because neck circumference is directly related to body mass, and because neck circumference is directly related to sleep apnea, it is easy to see why obese patients are more prone to suffering from sleep apnea. However, if one were to lose enough weight, making their neck the proper circumference as compared to to their body size, their airway would stay clear and a patient could experience relief from their sleep apnea symptoms, as suggested by physicians at Mayo Clinic (Losing excess weight increases chance of eliminating sleep apnea, 2010). Another study completed by physicians and researchers in Finland expands on this claim, stating that patients who lost more weight over a 5 year period showed a significant improvement in sleep apnea symptoms, as compared to patients who had less weight loss (Kulkas et al., 2015). Because many obese patients complain of weakness and fatigue, it is probable that by treating their sleep apnea that they will have a decrease in these symptoms, thus improving the overall feeling of wellbeing.

Quality of Life

Americans live a very rapid, perhaps hectic lifestyle. According to the American Bureau of Labor Statistics Survey, we, as a society, spend an average of 8.9 hours completing work-

related tasks, including commuting to work, 2.5 hours partaking in leisurely activities, such as working out or reading, 1 hour completing household activities, such as cleaning, 1.2 hours caring for others, 1 hour preparing food and eating, 1.6 hours doing other miscellaneous activities, and 7.7 hours sleeping (Bureau of Labor Statistics, American Time Use Survey 2016). For most, these activities take place one after another in a very chronological, planned-out sequence with little room for alteration in the schedule of events. This lifestyle can often lead to a feeling of comfort, stemming from the familiar routine; however, the danger is when this routine becomes filled with poor decision making and lifestyle habits, one's overall well-being can begin to deteriorate.

There are many typical diseases that most obese patients are at the greatest risk for, however being obese is a risk factor for an innumerable amount of other diseases. Along with the potential of succumbing to both chronic and acute diseases, I argue that being obese leads to a generalized decreased in quality of life. (What Are the Health Risks of Overweight and Obesity?, 2012). At first thought, I figured that "quality of life" would be defined using simple figures of various factors such as lifespan and disease prevalence, however, this term is multifaceted, complex, and difficult to define in one simple phrase or idea. Various sources have defined the term in the following ways:

- Center for Disease Control and Prevention: "A broad multidimensional concept that usually includes subjective evaluations of both positive and negative aspects of life. What makes it challenging to measure is that, although the term "quality of life" has meaning for nearly everyone and every academic discipline, individuals and groups can define it differently. Although health is one of the important domains of overall quality of life, there are other domains as well—for instance, jobs, housing, schools, the neighborhood. Aspects of culture,

values, and spirituality are also key domains of overall quality of life that add to the complexity of its measurement.” (Health Related Quality of Life, 2016).

- Oxford English Dictionary: “The standard of health, comfort, and happiness experienced by an individual or group.” (Oxford English Dictionary)
- Medicinenet.com: “The patient's ability to enjoy normal life activities.” (Definition of Quality of Life, 2016).
- Ecological Economists: Quality of Life is the extent to which objective human needs are fulfilled in relation to personal or group perceptions of subjective well-being (Costanza et al., 2007).
- Forbes.com: "Quality of life" is subjective and multidimensional, encompassing positive and negative features of life. It's a dynamic condition that responds to life events: A job loss, illness or other upheavals can change one's definition of "quality of life" rather quickly and dramatically (Barcaccia, 2013).
- National Cancer Institute: Quality of life, “Is the state of well being that is a composite of two components: the ability to perform everyday activities that reflect physical, psychological, and social well-being; and patient satisfaction with levels of functioning and control of the disease” (Gotay et al., 2015).

Though this term, “Quality of Life” is clearly multidimensional in nature, I, and seemingly all of the references mentioned above, believe that health is one of the most important factors that play into a high quality life. Being obese is a condition that nearly 1/3 of the American population deals with on a daily basis (Fitzgerald, 2013). The disease has become a norm in our culture, but perhaps this is the very reason that we are set back behind other countries when it comes to ranking the most healthy to the least healthy. Perhaps, if we as a

nation endorse health in a more public manner, we could eradicate this condition all together and, as a society, increase our quality of life.

I argue that being obese is detrimental to one's life because it hinders a person from partaking in typical daily activities. People who bear more weight on their bodies have a much harder time completing normal functions such as walking, climbing stairs, bending over, getting out of bed, and other necessary activities to fulfill the typical American lifestyle. A study by researchers in Italy supports this claim, seeing as they found that patients who were obese reported having more difficulty in everyday life activities such as mobility, employment, home chore completion, sex life, celebrating holidays, and partaking in hobbies. (Marchesini et al., 2003). Clearly, obese patients are not only at risk for life threatening-physical diseases, they also must combat various burdens in order to compete daily life activities.

Along with physical threats to health and daily lifestyle patterns, being obese puts a person at risk for several mental illnesses. A studied completed by researchers in Queensland, Australia collected data from over 1,200 obese volunteers ages 45-54 and asked them to complete a survey regarding their physical health, and emotional responses to common social activities and work. This data was compared to that of normal-weight volunteers and results suggest that those who were obese tended to have a significantly higher prevalence of symptoms that align with mental illnesses such as depression and anxiety (Nauert, 2015). Researchers in the Duke University Diet and Fitness Center found similar results, suggesting that those who were obese had a tendency to struggle with emotional responses, particular self confidence and sex drive. They also noted that as the level of obesity increased from obese to morbidly obese, self confidence and sex drive decreased even more as compared to non-obese participants in the study (Binks, 2005). Clearly, quality of life can be negatively impacted for patients struggling

with their body weight, making them not only vulnerable to physical health issues, but also mental health issues. The sources listed above not only state that quality of life is measured by mental health, but also by the ability to partake in typical daily activities for an average person. Perhaps, if people were to lose the weight on their bodies that studies have shown to have negative impacts on one's mental health, they would not only be more mobile, energetic, and able to complete simple, necessary tasks, but would also have an increase in their mental health and a higher quality of life.

Conclusion: Can we solve this problem?

Mick Cornett, the mayor of Oklahoma City, gave a TED talk on his city's obesity problem in 2013. In this talk, entitled *How an Obese Town Lost a Million Pounds*, mayor Cornett explained how his town went from among the unhealthiest of U.S. towns to one of the healthiest. He first became aware of his city's lack of health when he stumbled across a ranking posted online, similar to how I came across Bloomberg's ranking of the healthiest countries. Mayor Cornett states,

“The media and the internet love to rank cities. And in Oklahoma City, we'd never really been on lists before. So I thought it was kind of cool when they came out with these positive lists and we were on there... Best city to get a job, best city to start a business, best downtown- Oklahoma City. And then came the list of the most obese cities in the country. And there we were”. (Cornett, 2013).

Cornett was first inspired to encourage his city to lose weight when he looked at himself in the mirror. He states that he always knew he wasn't the healthiest of people, but once he went online and filled out a short questionnaire, he realized he was not just “chubby”, but was rather *obese*. With this new-found realization of how unhealthy he had become, Cornett started to look around his town and realized how severe the obesity problem was all throughout the town. He explained that the town was set up so that everyone had to drive cars, there were plentiful fast food options, and very little spaces were set aside for people to be active or spend time in the outdoors. Ashamed of himself and his town, Cornett got to work. He initiated projects that would construct a 70-acre park in the center of his city, build multiple wellness centers, redesign the layout to be more convenient for pedestrians to get around, and install 100 miles of biking trails. This initiative by Mayor Cornett began in the winter of 2007 and just 5 short years later real results were seen, as the city had lost over 1 *million* pounds. Amazingly, while in New York to talk on the Rachael Ray show in 2012, Mayor Cornett picked up a copy of Men's Fitness Magazine and saw the headline, “America's Fattest Cities: Do You Live in One?”. Cornett explains that he picked up magazine, expecting his town to still be on the list. But, much to his surprise, they weren't. Rather than being on the list of the most unhealthy U.S. cities, Mayor Cornett found himself and his Oklahoma City residents on

the opposite list, the list of America's most healthy cities. After just 5 short years, Oklahoma City managed to go from one of the unhealthiest, most obese U.S. cities to 22nd on the list of America's most healthy cities. (Cornett, 2013).

I watched this TED talk with interest in the title, but after finishing it, I was inspired. Though Oklahoma City is only a microcosmic piece of the entire United States, Mayor Cornett made it obvious that there is a real potential in reclaiming our health and climbing toward the top of world-wide health lists. I believe Mayor Cornett was able to have such success in this initiative by bringing his city together. He explained that the whole city, including large companies, small companies, families, schools, and clubs all worked together to contribute to the 1 million pounds lost throughout the entire metropolis. Because there was a common sense of camaraderie throughout the town and everyone was striving for the same goal, Mayor Cornett was able to effectively motivate his citizens to joining him in the pursuit of health.

America needs to have some type of inspiration to make similar changes, similar to how Oklahoma City did, but on a national level. I would argue that most Americans do not even know how unhealthy we are on a global scale. So, in order to instigate change, we first ought to start with education. American citizens need to know that their country is not only one of the most powerful, free, and wealthy countries, but that we are also lacking in one particular area. We are an overweight, unhealthy country that needs change. We ought to work together as a nation and fight for our health and claim a place on the top of the worldwide health ranking, similar to how we have on other rankings. Perhaps if more Americans are aware of the problem, and in results ashamed like me, they will have similar motivation to tackle the problem and end this era of obesity and lack of overall health throughout our country.

One of the best, most motivating pieces of work I have seen is the *Fed Up* documentary headed by Dr. Mark Hyman. This film points out the issues America has within its food industry and gives heart-wrenching information about how it is affecting our country's people. The video follows young children through their school lunch line as they make meal selections and exposes how marketing, such as advertisements for chocolate milk or pizza, alters their lunch-time decisions. Two obese twelve year olds,

Brady Kluge and Maggie Valentine, are interviewed in the film and explain how they feel helpless when it comes to weight loss because, though they eat seemingly healthy foods, such as low-fat crackers and sugar-free soda, they still fail to lose any weight. Though these are two specific examples, issues like this are dealt with by children and adults across all of America.

From this film, I have realized just how manipulative our food industry has become. People are told that “sugar free”, “fat free”, and “Diet” products are good for you, but are they? These foods have been overly processed, had multiple additives, and use chemicals, sugars, and sugar substitutes to make up for the lack of nutrients and flavor that industrialization of the food market has caused. But, the film’s most basic concern for America as a whole is the message that food companies are presenting to their consumers. The film describes childhood obesity as an epidemic that is comparable to an internal threat. Plenty of medical-based industries have developed in response treating weight gain and its associated diseases, but what about the foods we buy at the grocery store? Foods sold in American supermarkets have yet to change in their approach to citizens and their weight gain. Unhealthy, manufactured foods are still sold and marketed throughout the country, despite the fact that they are one of the leading causes of the obesity epidemic.

The film follows multiple children such as Brady and Maggie throughout their lives as obese members of society. The kids featured struggle with weight gain and admit that they know they should not be eating the foods they do. The families of these children follow similar eating regimens, which all tend to follow the American health guidelines suggested by campaigns such as Myplate, which try to guide Americans in their eating proportions. However, when they try to eat healthy, these families hardly even know how to start. Grocery stores offer confusing messages and various books about “healthy” diets contradict one another on what a person should and should not eat. In all, I believe that our country is not only confused, but perhaps tricked into eating what we do. If more people were to know the biochemistry behind what the sole purpose of food is, perhaps these unhealthy foods would be bought less often and more nutritious foods would be consumed by our society. Some say that we just need to eat less and exercise more by practicing more willpower and motivation, but is this the answer? Absolutely

not. Biochemistry has proven that exercise and calories in vs. calories out are hugely important in fitness and weight loss. If more calories are consumed in a diet than what is burned off through exercise, the extra energy will be stored away in the body, in case it is needed for future use.

Diet crazes have been popular in America because they tend to tell people that by avoiding certain food groups weight loss can be achieved. Take the Atkins diet for example. This program encourages dieters to avoid carbohydrates, however this cannot be healthy on a cellular level because carbohydrates are one of the most important sources of fuel for a body and without them, the body finds itself desperate for energy and turning to more difficult-to-metabolism sources, such as protein and fat. Another common diet fad is the Paleo diet, which instructs a person to only eat what could be “hunted or gathered”, limiting the diet to mostly just fruits, vegetables, meats, and nuts. Though it sounds healthy in theory, this diet can lead a person to avoiding certain foods which could actually be very good for their body. For example, grains such as oats, wheat, and rice, cannot be eaten, despite the fact that they are great sources of carbohydrates, along with legumes and beans, which are packed-full of protein. One of the final, most popular crazes in America when it comes to dieting, is the low-calorie diet. In theory, this diet sounds to be ideal, given that it encourages dieters to keep an eye on how many calories they eat in a given day and doesn't exclude any particular sources of fuel. Diet crazes may seem to be promising at first, given that they offer an “easy” way to lose weight, but limiting the diet to only certain types of foods can lead to issues within the body as it tries to synthesize energy.

However, we cannot just decrease caloric intake or force our bodies to be more active, we need to actually control how we fuel our bodies, all starting on a cellular level. For example, eating a healthy meal with the proper proportions of carbohydrates, proteins, and good fats would better fuel a body as opposed to a cheeseburger and soda, even if both meals were the same amount of calories. This is because the well-balanced meal has foods that are most needed by the body to think, move, and operate. Though a cheeseburger has some nutritional value, there is only a small amount of protein in the meat patty, some poor-quality, starchy carbohydrates in the bun, and difficult-to-metabolize saturated fats in the meat and cheese.

The best way to motivate a society to change is through nation-wide messages that educate all citizens of the problem their country is struggling with. I believe that if more people saw the *Fed Up* documentary, or others like it, they would be more motivated for change. When I personally watched the film for the first time I found myself in awe. I had noticed that we were a rather overweight country, but I had never noticed just how unhealthy we really were. Videos have circulated on the internet, similar to that I previously discussed, that explain how other countries view our nation. Most commonly, foreigners commented on our weight. Nearly everybody who is not American can identify an American group of people based on their body size. This is shameful. Perhaps if we all knew information like this, we could start to make changes. We are all individuals that make up a nation; if more and more individuals have similar feelings to those that I have, there is hope that our country can be cured of its obesity epidemic.

Various campaigns in the past have explained that “A calorie in is a calorie out”, or that if you eat less calories than you burn, then you will lose weight (Hiscock, 2012). Margo Wootan, Director of nutrition policy at the Center for Science for Public Interest explains in *Fed Up* that, “We will not exercise our way out of the obesity problem” (Morgan, 2014). Calories can be burned for various different processes; whether a person is sleeping or running, a calorie burned is a calorie burned. However, calories eaten play hugely different roles in our bodies. Some, when associated with fiber, are digested into the body extremely slowly, giving us a longer release of energy. However, other calories, such as those eaten with sugar, are quickly burned for energy, forcing our bodies to store the excess sugar into fat cells because the sugar had very little nutritional output beyond energy. So, according to Dr. Wootan, if people were more aware of what different calories were responsible for doing, then perhaps they would choose which calories they ingest more wisely.

Several factors play into the American lack of health. We tend to eat an abundance of food, and often do not successfully use all of that fuel on a cellular level to maintain bodily function, forcing it to store up in our adipose tissue. This excess fat on our bodies is anything but healthy. Sure, some adipose tissue could be a good thing, as it would allow a body to continue functioning when it was in a situation when food was lacking. However, in today’s day and age, the typical American rarely finds themselves in

a situation where food is not readily available and easy to access. Along with this, the food that we are surrounded by is most commonly very unhealthy, meaning that not only are we overeating, but we are overeating unhealthy foods that do not properly provide our cells with energy.

A healthy lifestyle is something that I was taught at a very young age. My brother, Ryan and I have a mother that is particularly over-protective when it comes to the types of foods we eat. We spent a fair amount of our childhood crawling, running, and playing hide-and-go-seek in the towering rows of Vitamin Cottage as our mom perused the aisles, seeking out the healthiest snacks, teas, and gummy vitamins to fuel our energetic lifestyles. Ry and I were even given rules to follow when not under our mama's careful watch; at volleyball tournaments I wasn't allowed to drink blue Gatorade, given the studies that related it to cancer, and we were instructed to avoid chips, pastries, and soda at daycare and friends' houses. "Why do you think mom was so crazy about our health as children?" I asked my brother one day. Seemingly puzzled and caught off guard by this question, Ryan said, "I don't know Jen, our mom is protective and cares a lot about our physical and mental wellbeing". At this point, it dawned on me that Ryan and I were raised in an extremely health-conscious household by a mother who obsessively read books and stayed up to date on the latest health food crazes, ensuring that her kids were always eating the best foods possible. In our family, books were often bought and read, the internet was accessible, and our mom would use these resources to ensure that we ate healthy and stayed active. However, this may not be the case for everyone.

As I am growing older and becoming more aware of the lack of health my country has, my passion for changing these issues is growing stronger. Citizens of America ought to be able to access healthy foods, and active lifestyles should be endorsed. Twenty years ago, when Ryan and I were kids, our mom had to do a fair amount of research to figure out what was healthy and what was not. However, in today's day and age, resources for health are so abundant that it is overwhelming. For example, when Googling, "What is Healthy?" over 500 *million* results are pooled within half of a second. Clearly, the resources necessary to attain a healthy life are accessible, though dissecting these results is another story. In my opinion, one of the best ways to help America start to tackle this problem is to both teach citizens

what health is and aid them in accessing proper resources for health, whether it be information, healthy foods, or opportunities to play sports or workout.

Perhaps the best way to start tackling America's obesity epidemic is to implement changes similar to what Mayor Mick Cornett did in Oklahoma City. First, I would suggest that the issues regarding health in America be advertised across the nation, hopefully igniting inspiration and motivation to change. Then, methods to start such changes should be implemented and made accessible to citizens. For example, perhaps lunch menus could be restructured in American schools, narrowing food choices to only what is healthy while endorsing properly balanced meals. Along with this, more access to recreation ought to be implemented to encourage lifestyle changes, such as enhancing sidewalks and bike lanes to promote walking and biking to work or to run errands. Finally, I'd hope that citizens would use their inspiration to be healthy in order to start making these changes in how they understand health and use it as a guide through choices such as what foods to eat or not eat.

The most basic unit of life is a single, microscopic cell. If we don't take care of cells on an individual basis, we will eventually have catastrophic, large-scale bodily issues such as weight gain, which can lead to life-threatening and quality of life-threatening diseases and symptoms. As this type of process happens to more and more individuals, an entire society can start to struggle with the issue, leading to an epidemic. Though epidemic may be a strong word for this situation, it is an accurate word for the American obesity crisis. Our bodies, in general, have become inundated with fat stores and have begun to develop into a large-scale problem. However, this is a problem that I believe we are capable of fixing.

With education and awareness regarding the causes of the obesity epidemic, Americans can start to learn how to avoid weight gain, allowing them to avoid the other conditions it can quickly lead to. Though being the 33rd healthiest country in the world is a rather embarrassing statistic, if more people become aware of this ranking, I hope that they will realize a change needs to be made nation-wide. However, in order for such a large-scale change to take place, Americans ought to come together as a nation of united citizens to start these changes. As more people start to channel their inner potato sack

race winning, trivia night dominating, and mountain summitting competitive edges, I believe that we could spark a change that is rooted in American pride and value of being one of the best countries in the world.

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