My body aches as I trudge through daily activities. Even placing one foot in front of the next seems laborious. Further, my airways are partially blocked because of mucus accumulating in my sinuses. I contemplate how I took a smooth breath for granted. Most people today would deduce that I have fallen under the influence of the common cold. They would also likely conclude that my cold originated from some strain of bacteria. Although this idea may seem elementary by today's standards, Germ Theory, the belief that diseases arise from microorganisms like bacteria, is a relatively new concept.

For centuries, society widely held an entirely different belief about the origins of disease—one that associated disease with poisonous vapor. The Miasma Theory, a concept asserting that decaying matter in foul-smelling air caused diseases, reigned as the "scientific truth". Believers in the theory stressed preventative approaches such as cleansing to avoid infection. The belief originated in the Middle Ages and endured into the 1900s. The airborne nature of the disease is why physicians during the Bubonic Plague wore the iconic bird-like masks. The masks ostensibly protected the doctors by containing a respirator with dried herbs and flowers in the beak to combat noxious smells. Unfortunately, the masks did not address the actual issue, bacterial infection. As a result, many plague doctors passed away from the disease. Although the plague eventually subsided, the Miasma Theory stood strong. It was not until the late 1840s that it would be substantially challenged.

The first threat to the Miasma Theory came in the wake of the Industrialization Age of London, when pestilence ran rampant through the streets. The rapid industrialization led to unfit living conditions. Urban areas of London were poor, filthy, densely-populated, and foul-smelling neighborhoods, so they tended to be ground zero for epidemics. One such epidemic was the outbreak of Cholera in the SoHo area of London. This disease was characterized by acute diarrheal infection that proved to be fatal within hours. Based on the Miasma Theory, Londoners believed the deadly disease was spread through toxins hovering within the SoHo air.

Physician John Snow held skepticism in the etiology. He noticed that his patients' symptoms were centralized in their digestive tracts instead of their lungs. Snow's doubt in the legitimacy of the Miasma Theory grew into a full investigation of a Cholera outbreak. Snow found that the vast majority of the infected lived around the Broad Street water pump. He hypothesized

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that the Cholera outbreak was due to a water supply contamination from a nearby sewage pipe. The English physician was beginning to formulate his rejection of the Miasma Theory.

After collecting samples from the water supply, Snow observed the potentially hazardous water under a microscope. He noticed microorganisms swimming in the liquid, proving his contaminated water theory. Snow requested Parliament to shut down the Broad Street water pump to contain the SoHo Cholera epidemic. Although Parliament was slow to respect Snow's request, the watering pump was eventually shut down. Correspondingly, the Cholera outbreak subsided. John Snow's work to prove that the source of the disease was contaminated water stood as the first step toward Germ Theory. Others would follow in Snow's footsteps to invalidate Miasma Theory.

The next important scientist was Louis Pasteur, a French chemist who established himself in the medical world with an array of legacies. Three of his most impactful discoveries involved the beer industry, the silk industry, and the development of the first vaccine. In 1856, Pasteur investigated why

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certain beers were prematurely spoiling. He examined samples and found thousands of microorganisms in the beer to be the cause of the issue. Pasteur concluded that microbes putrefied the beer when he discovered that heating the beer killed them and preserved the drink. This microbicide technique is known as pasteurization, and it is widely used today to preserve drinks like milk, beer, and wine. This discovery heavily influenced several industries and brought forth the notion of microorganisms' effect on beverages. However, it was not until Pasteur's next two discoveries that public health was forever changed.

In 1865, Pasteur was approached by a man from the silk industry seeking help. His silkworms were dying from a disease called pébrin at a rapid rate, and it was slowing his production. Pasteur accepted the challenge

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and visited the factory. After several experiments, the chemist concluded that the silkworms were inflicted with multiple diseases that were spreading through the consumption of infected feces. This conclusion proved significant because it showed that diseases could spread through microbes into living organisms. His victories in industry added substantial support to the developing Germ Theory. Pasteur's next discovery would be the final and most convincing point for the young Germ Theory and would change medicine forever.

In light of Edward Jenner's development of the smallpox vaccine, Pasteur hypothesized that there was a different vaccine for every disease. The French chemist utilized Cholera cultures from chickens to test this theory. He cultivated Cholera and found that injecting healthy chickens with the culture would induce the disease. In the summer of 1880, he found a forgotten Cholera broth. When he inoculated the chickens with the old broth he found that the chickens did not die. In fact, he proved that the old broth provided a resistance to subsequent Cholera exposure. This discovery provided a vaccine for Cholera as well as concrete evidence that germs are the root of disease. Germ Theory would be further refined with a third's physician's findings—Robert Koch.

Koch, a German physician, cemented Germ Theory by building on Pasteur's work. The doctor followed Pasteur's rudimentary Germ Theory by proving specific microbes cause specific diseases. Koch extracted a blood sample of a deceased, anthrax-infected sheep. He then cultured the anthrax and injected it into a mouse. He found that infected mice suffered from anthrax too. In 1876, after generations of repetitions of the experiment, Koch concluded that the specific bacteria strain was the cause of anthrax. Robert Koch's discovery propelled the scientific community toward accepting Germ Theory. The physician proved not only that diseases arise from microbes, but also that a specific disease is inflicted by a specific microbe. Koch's work led him to be one of the founders of bacteriology.

The tremendous efforts of John Snow, Louis Pasteur, and Robert Koch drove Germ Theory to where it stands today. John Snow fought against adversity for the public health of his fellow Londoners. Louis Pasteur established that microorganisms bring about diseases. Robert Koch developed a vaccine for anthrax and determined that specific bacteria lead to specific diseases. These discoveries built our understanding of germs today. It is hard to believe it was not until the end of the 19th century when Germ Theory became widely accepted, since we take this theory as a given in modern society. Reflecting on these scientists' arduous path to establish a scientific truth begs a question about modern society: what truths do we blindly disregard today because they simply differ from the current belief?