# GERM THEORY LOUIS PASTEUR pdf

## 1: Louis Pasteur, the Father of Immunology?

*Louis Pasteur invented pasteurization and discovered the germ theory of disease, thus advancing the science of microbiology and saving millions of peoples' lives.*

Received Feb 5; Accepted Mar  This is an open-access article distributed under the terms of the Creative Commons Attribution Non Commercial License , which permits non-commercial use, distribution, and reproduction in other forums, provided the original authors and source are credited. This article has been cited by other articles in PMC. Abstract Louis Pasteur is traditionally considered as the progenitor of modern immunology because of his studies in the late nineteenth century that popularized the germ theory of disease, and that introduced the hope that all infectious diseases could be prevented by prophylactic vaccination, as well as also treated by therapeutic vaccination, if applied soon enough after infection. However, Pasteur was working at the dawn of the appreciation of the microbial world, at a time when the notion of such a thing as an immune system did not exist, certainly not as we know it today, more than years later. Accordingly, why was Pasteur such a genius as to discern how the immune system functions to protect us against invasion by the microbial world when no one had even made the distinction between fungi, bacteria, or viruses, and no one had formulated any theories of immunity. Even so, he focused attention on immunity, preparing the ground for others who followed. Louis Pasteur, microbe, vaccination, chicken cholera, anthrax, rabies, immunity, attenuation The microscope or the telescope, which of the two has the grander view? By comparison, in addition to his many contributions to microbiology, Pasteur introduced the concept that vaccination could be applied to any microbial disease, and he reported methods as to how the virulence of microbes could attenuated so that live microbes could be used to make prophylactic vaccines that could be made in the laboratory and manufactured in unlimited quantities for use worldwide. As if that were not enough, Pasteur also introduced the concept of therapeutic vaccines with his studies of rabies. Thus, he showed that what we now call post-infection prophylaxis could be used to treat individuals who were exposed to a virulent organism, and if applied soon enough after infection, clinical disease and death could be averted. Thus, he offered the hope that infectious microbial diseases could be both prevented and treated via immunology. Of course, Pasteur was working at the dawn of microbiology, and using careful quantitative methods, he had already shown that microbes such as yeasts caused fermentation of sugar to produce alcohol, and as well, microbes are responsible for putrefaction, or the decay of tissues. Also, over 20 years, he extended his experiments to show that spoilage associated with the dairy, beer, wine, vinegar, and silk industries was explicable by contamination with bacteria. Toward the end of his career, Pasteur moved from microbiology to the study of vaccines, a natural extension, to try to prevent infectious diseases in domestic animals. This change in scientific emphasis necessitated him to gain expertise in handling both small and large animals. To help him in this new experimental direction, Pasteur employed a young physician, Emil Roux. However, reading about this work now, I realized that the attenuated Yellow Fever Virus vaccine was made possible by a single random mutation, so that luck had a great deal to do with this vaccine. Those microbes that could be removed by filtration were relatively large and could be cultivated outside the body and observed to form colonies observable by the naked eye. These microbes were subsequently classified as belonging to the Kingdom of Bacteria. Other poisons were smaller and passed through the filters into the filtrate. These became know as viruses, and a filterable agent was the working definition of a virus until the s and s, when the electron microscope allowed a magnification of 10 million times, powerful enough to enable their visualization. With this as a background, I wondered how Pasteur had attenuated the microbes that he used for his live vaccines, especially the attenuation of bacteria. From experiments beginning in the s, it became known that viruses, such as poliovirus, could be attenuated by prolonged passage in tissue culture, but exactly how this worked in many instances remained unknown until recently. Now, we know that prolonged passaging of viruses in tissue culture cells allows for the accumulation of many spontaneous random mutations throughout the genome. However, exactly which of the mutations cause the loss of virulence of a particular organism usually remains obscure, even today. Therefore, how was Pasteur so brilliant that he could have accomplished this feat with bacteria more than years ago? We still cannot attenuate bacteria easily. Moreover, bacteria have their own viruses that can introduce virulence encoding genes. Now, most of our vaccines against bacterial diseases are not live attenuated organisms. Instead, they consist of parts of the microbe, and are called subunit vaccines, and by definition, they are not living. And how could he have attenuated the rabies microbe, which is now known to be a virus and not a bacterium? And why did his therapeutic vaccine for rabies work so well? We would love to create such a vaccine for diseases such as the Acquired Immunodeficiency Syndrome, due to infection by the Human Immunodeficiency virus. The Ancients and the Secret of Life Our view of our world has necessarily depended on our abilities to actually perceive the nature of our surroundings. The ancients, in particular Aristotle, did not have the advantage of peering through a microscope so as to magnify images many-fold. Consequently, the Greeks concluded that the world is made up of those elements that one could perceive with the five senses; fire, earth, water, and air. Furthermore, living things, plants, and animals, were thought to arise spontaneously from inanimate i. Animals and plants come into being in earth and in liquid because there is water in earth, and air in water, and in all air is vital heat, so that in a sense, all things are full of soul spirit. Therefore, living things form quickly whenever this air and vital heat are enclosed in anything. When they are so enclosed, the corporeal bodily liquids being heated, there arises as it were, a frothy bubble. Thus, Aristotle described both putrefaction, the decay of living things, as well as fermentation, the giving off of gas and heat, associated with the decay of living things. The Renaissance and the Microscope These thoughts persisted through two millennia, until the late renaissance in the seventeenth century. However, it was not until the early nineteenth century that microscopes were improved to the magnification of our modern microscopes. The dogma at the time held that both putrefaction and fermentation occurred as a result of the oxygen in the air acting upon organic substances, such that it was only a chemical reaction, and not due to the spontaneous generation of life forms from inorganic materials. Schwann goes on to state: Microscopic examination of the beer yeast showed the familiar little grains kornchen which the ferment forms, but the majority of these were connected in chains. They were partly round, but mostly oval grains of a light yellow color, which occasionally occurred singly, but most often in chains of two to eight or more Schwann, A year later, Charles Cagniard de la Tour goes on to say Cagniard-latour, I am acquainted with the principal literature concerning alcoholic fermentations, but I have seen no work in which the microscope was used to study the phenomenon on which it depends. The principal results of the present work are: Louis Pasteur and the Germ Theory: Putrefaction and Fermentation These rudimentary experiments, the observations and the conclusions, are very important, especially because they were largely ignored for 20 years, and only became accepted when Louis Pasteur repeated these same experiments and first announced them to the Academie des Sciences in a series of presentations beginning in Pasteur, Louis Napoleon was freely elected President of the Second Republic after the revolution of , but he then usurped power and declared himself Emperor in Pasteur was a sincere believer in a Creator-God, and was emblematic of the nineteenth century French bourgeoisie, a fervent patriot, Bonapartist, and political conservative. Subsequently, Pasteur correlated this optical asymmetry, detected with a polarimeter of the polarization of light by molecules in solution, with the asymmetry of their crystals derived from each of the optical isomers. Thus, Pasteur believed that he was on the verge of discovering one of the fundamental principles that distinguishes living from non-living materials, in other words, the secret of life. Pasteur made the metamorphosis from chemist to microbiologist at the age of 35 because of a decision to focus on amyl alcohol, which he details in the introduction to his paper on lactic fermentation Pasteur, I established that amyl alcohol, contrary to what had been believed hitherto, was a complex substance formed of two distinct alcohols, one deviating the plane of polarization of light to the left, the other devoid of all optical activity. Pasteur had come to believe that the optical properties of his two amyl alcohols could only be explained on the assumption that asymmetry, and thus life, somehow intervened in their production during the process of fermentation. These preconceived ideas idees preconsues essentially drove his scientific metamorphosis. In his pursuit of his point of view, he challenged some of the leading chemists of his day, notably Justus von Liebig of Germany and Jacob Berzelius of Sweden. However, this view had been challenged, even ridiculed by Liebig and Berzelius, who both insisted that the process was chemical rather than biological. Thus, before Pasteur could examine the effect of fermentation on amyl alcohols, he had to prove to himself, and others, that fermentation only occurred in the presence of living microscopic organisms. In his report on lactic fermentation, Pasteur reports the accumulation of material: Under the microscope it is seen to form tiny globules or small objects which are very short, isolated or in groups of irregular masses. These globules are much smaller than those of beer yeast and move actively by Brownian movement. Thus, he accumulated observations consistent with his hypothesis that lactic fermentation occurs in the presence of living organisms. In addition, as a chemist Pasteur argued that if lactic fermentation were a straightforward chemical reaction, it should lead to only the reactants and product s of the reaction. However, he reproducibly found several substances resulting from lactic fermentation: Lactic acid is indeed the principal product of the fermentation which has been given its names but it is far from the only product. Butyric acid, alcohol, mannitol and a viscous material are always found accompanying the lactic acid. Thus, Pasteur the chemist argued that only a living process could elaborate such a complex mixture of molecules. In his introduction, he detailed the previous work on the biological nature of fermentation. In Leeuwenhoek studied beer yeast under the microscope and found very small spherical or oval globules, but the chemical nature of this substance was unknown to him. Fabroni identified the yeast with gluten. This was some progress. It gave an indication that yeast might be an organic product. Thenard published a memoir in which he said: All natural sugary juices, in the process of spontaneous fermentation, deposit a substance which resembles beer yeast and which has the power of fermenting pure sugar. This yeast is animal in nature, since it is nitrogenous and yields ammonia upon distillationâ€¦ In his observations published in and , M. Cagniard de la Tour introduced a new idea. Before his time, yeast had been regarded as a vegetable product, produced in situ, which precipitated out in the presence of a fermentable sugar. Now, it is classified to belong to the Fungi Kingdom. This opinion immediately found a powerful opponent in M. In his eyes, the ferment is an extremely unstable substance which decomposes itself and which causes fermentation as a result of the decomposition which it itself undergoes, during which it communicates this perturbation and dissimilation to the fermentable material. He expresses himself thus: He can show that nitrogen in the form of ammonia can be used, and that all one needs in addition is sugar and a very small amount of yeast. It can be stated with certainty that the ammonium salt is indispensable for the fermentation. When yeast is seeded into a sugar solution containing yeast ash but no ammonium salt, there is hardly any sign of fermentation. The necessity of sugar as a source of carbon for the yeast globules has been sufficiently proven that it requires no further experiments. Therefore, all that is necessary to bring about the phenomenon of fermentation are these things: Reciprocally, globules of yeast are never formed without the presence of sugar or a carbohydrate material or without the fermentation of this material. Any statements which are contrary to this principle have been derived from incomplete or inexact experiments. He obtained an active alcoholic fermentation in what we would today call a synthetic or defined medium, consisting merely of trace elements, ammonium salt and sugar. The problem became considerably clarified by this observation, since it could easily be shown in such a defined medium that the fermentation always proceeded with the growth of the yeast, and the increase in protein in the yeast was accompanied by a decrease in nitrogen of the medium. Given his commitment to the living microbe explanation of both fermentation and putrefaction, it was almost inevitable that Pasteur would be drawn to the controversy surrounding the concept of spontaneous generation, which had prevailed from the time of Aristotle. Central in this debate were the experiments of Felix-Archimede Pouchet. In contrast to the chemist Pasteur, Pouchet was a generation older, and a respected biologist, with a special interest in embryology and reproductive biology. In , he published Heterogenie, ou traite de la generation spontanee, in which he presented all of the evidence in favor of spontaneous generation. However, by comparison to the pagan Greek belief, i.

## 2: Germ theory of disease - Wikipedia

*Pasteur extended the germ theory of fermentation to human and animal diseases, and speculated that diseases are also the result of germs growing in the body. With this in mind, he investigated several diseases including pÃ©brine and flacherie in silkworms, chicken cholera, anthrax in sheep, and rabies in humans.*

Check new design of our homepage! His pioneering studies laid the foundation for the modern-day understanding of diseases, their etiology as well as vaccine development. BiologyWise Staff Last Updated: Dec 18, Did You Know? In the fear of contracting germs, Louis Pasteur never shook hands with anybody, not even the kings and queens. We all know that when we are down with flu, it is a set of microbes that have invaded our bodies, thereby giving rise to the symptoms. In addition to this, we are also aware that boiling water and heating food items kills the germs, and makes them safe for consumption. But way back in the s, it was not this simple. We owe our current understanding of germs or microbes to a French chemist and microbiologist called Louis Pasteur. Apart from his germ theories of fermentation and disease, we also know him as the genius who gave us the process of pasteurization. Given below is a brief account of the germ theory of disease, as well as the significant experiments and observations of Louis Pasteur, his germ theory of fermentation and its extension to diseases. In the s, this idea was not widely accepted, and it took a series of experiments and hard work for Pasteur to prove that air contains infinitely small living organisms, and that these organisms are responsible for diseases. Such tiny living things, which we know today as microorganisms, were first observed by Antonie van Leeuwenhoek, way back in the s. Moreover, the presence of microscopic, disease-carrying agents was proposed by several individuals, hundreds of years before the time of Pasteur. Observations and speculation hinting towards the presence of germs and their involvement in disease also came from the works of Fracastorius, Edward Jenner, Ignaz Semmelweis, Agostino Bassi, John Snow, and several more. But the presence of tiny invisible organisms in air was ridiculed and considered to be a fanciful story. It was only in the s that this proposition was strongly backed by evidence that came from the experiments by Louis Pasteur, followed by pioneering studies by Robert Koch and Joseph Lister. This greatly revolutionized the approach towards the study of infectious diseases as well as the treatment methods. What paved the way for the Germ Theory of Disease? The s witnessed several studies about the generation of life, of which the spontaneous generation theory was much discussed. According to this theory, life originated spontaneously from inanimate objects. Much famous was the recipe for mice, which stated that a fully grown mice can be created from an old cloth and rotting wheat in mere 21 days. Disproving this theory was the first step towards the formulation of germ theory. Refutation of Spontaneous Generation The s witnessed several studies about the generation of life, of which the spontaneous generation theory was much discussed. At this time s , it was a less known fact that fermentation of beer was brought about by yeasts. His observation of live organisms in the broth led him to investigate the spontaneous generation theory, which stated that life arises spontaneously from nonliving matter. He performed a series of experiments that involved boiling water, broths and liquid media in flasks, exposing them to air to show the presence of microorganisms in air. One of his simplest but most significant and ingenious experiments that proved this premise has been illustrated below. Louis Pasteur took two swan-neck flasks containing a rich liquid broth, and boiled the broths. He retained one flask as it is; and broke the neck of the other flask. The broth in the first flask remained as it is; whereas the broth in the second flask became cloudy which indicated microbial growth. Dust particles in air entered the first flask but were stuck in the swan neck and could not travel into the broth. On the other hand, dust particles easily fell in the second flask, thereby introducing microbes into the broth. This experiment proved the existence of germs in air dust particles in air, to be precise , and served as the final nail in the coffin of spontaneous generation theory. This experiment silenced all the debates between germ theory and spontaneous generation theory of origin of life. Formulation of Germ Theory of Fermentation The above experiments led him to conclude that it was the microbes in the air that spoiled the fermentation broths. He further investigated fermentation processes for several other compounds like lactic acid, butyric acid, etc. In this pursuit, he formulated the germ theory of fermentation which states that each fermentation process is associated with a specific microbe. He also inspired other scientists to investigate diseases using this approach, and the rest is history. The papers submitted by Louis Pasteur and Robert Koch regarding their observations and therapeutic suggestion with respect to anthrax, constitute the first formal representations of the germ theory of diseases. While demonstrating that boiled water can remain sterile until it is exposed to air, he said: Never will the doctrine of spontaneous generation recover from the mortal blow of this simple experiment.

# GERM THEORY LOUIS PASTEUR pdf

## 3: Discovery of Pasteurization - Louis Pasteur

*Louis Pasteur's pasteurization experiment illustrates the fact that the spoilage of liquid was caused by particles in the air rather than the air itself. These experiments were important pieces of evidence supporting the idea of Germ Theory of Disease.*

December 27, in Dole, France Died: The discovery of vaccinations, pasteurization, and proving that germs cause disease. His family was poor and during his early education he was an average student who enjoyed art and singing. However, when Louis was exposed to science as a teenager, he knew he had found his calling. He earned degrees in mathematics, physics, and chemistry. He then became a chemistry professor at the University of Strasbourg. He and Marie married in  They had five children, however, three died young from typhoid fever. It was the deaths of his children that drove Louis to investigate infectious diseases in order to find a cure. Pasteur ran experiments to see if this was true. Through his experiments he proved that germs i. This was a major discovery in the study of biology and earned Pasteur the nickname the "Father of Germ Theory. He found that heating up the liquids would kill most of the microbes and allow the beverages to last longer and be safer to drink. This process became known as pasteurization and is still done on many foods such as milk, vinegar, wines, cheese, and juices. Silk Worms As Pasteur learned more and more about bacteria, he began to think they may be the cause of disease in humans. When the French silk market was threatened by a disease to silkworms, Pasteur decided to investigate. He discovered that this disease was caused by microbes. By eliminating the microbes from the silkworm farms, he was able to end the disease and save the French silk business. Vaccinations Pasteur continued to investigate with diseases. He found that he could make a weak form of a disease that would cause people to become immune to the stronger form of the disease. He called this weak form a "vaccine. The first vaccine he gave to a human was the rabies vaccine. He administered it to a nine year old boy name Joseph Meister in  Legacy Today Louis Pasteur is known as one of the most important scientists in history. His discoveries led to an understanding of microbes and diseases that has helped to save millions and millions of lives. Pasteur is most remembered by the Pasteur Institute which he established in  Today the Pasteur Institute is one of the world leaders in battling infectious diseases. Louis Pasteur died in from a stroke. Interesting Facts about Louis Pasteur Early on in his career Pasteur studied crystals and discovered why some crystals bend light while others do not. He was a deeply religious Christian throughout his life. He once said that "In the field of observation, chance favors the prepared mind. Your browser does not support the audio element.

# GERM THEORY LOUIS PASTEUR pdf

## 4: Biography for Kids: Scientist - Louis Pasteur

*However, scientific proof of the theory was the achievement of two European scientists: Louis Pasteur, a Frenchman, and Robert Koch, who was German. The birth of pasteurisation. Pasteur was a chemist: his early research focused on the study of crystals.*

The microbe germ is nothing. The terrain milieu is everything. There are many variations of this recant. But the essential admission is intact. The Back Story Three nineteenth century Frenchmen researched fermentation, microbes, and contagious disease: Pasteur and Benard were very close and over long stretches of time took care of each other. One account said Pasteur never recovered the use of his left hand or leg. In he had a second stroke. Other accounts describe the "attack" as a stroke. He was attended around the clock by two people at a time. His condition had improved by the end of December. At one point a tent was put up for him in the garden of the Pasteur Institute in which he often spent afternoons. By June his condition had deteriorated and the paralysis increased. He died there on Saturday, September 28, at 4: His final illness lasted eleven months. An English translation was published in  He is unlikely to have done anything to discredit Pasteur, in fact his biography notably omits stories critical to Pasteur. This collection is the largest in existence. In Baltimore, Maryland Dr. In Hume published Bechamp Or Pasteur? Ethel Douglas Hume rewrote her book. It was published in , , and by C. Daniels; it was published in by Bookreal with a new title: Shortly before his death he gave the papers to Dr. This book does not contain the recant. I transcribed the following excerpt from page of the revised edition: They said he was too one-sidedly preoccupied with the apparent cause of disease: In any event, it is rather significant that Pasteur attached so much importance to this point that on his deathbed he said to Professor A. The microbe is nothing, the soil is everything. Le Cas Pasteur" begins on page total pages. It has notes and a bibliography. It is in French, has pages, and a preface by Philippe Decourt. In April an article by Christopher Bird â€" , a science writer, was published in Nexxus Magazine. Well, the last page of the book is , and there is no mention of the recant on it or earlier pages. Confirmation or Not The difficulty for American researchers who do not read French is that most of the key books in this saga were written in French and have yet to be translated into English. I still hope to find a French-reader to look for the recant in the books of Nonclercq and Decourt. I no longer believe that. At this point, , I have found no evidence that the recant was real. It was likely also in the edition. An engaging question is how the recant story ended up in print, assuming it is true. There is the additional possibility that Pasteur confessed to more than one person. A Brief Criticism of Pasteur candida-international. The falsifications committed by Pasteur now seem incredible to us. On deeper examination, however, the facts were in opposition to the ideas developed by Pasteur in the domain of bacteriology. The Third Element of the Blood. Translated from the French by Montague R. Available as a free e-Book on Google Books. Available on Google Books and Amazon which has a text viewer. Also available in PDF form at www. This document is published by becahmp. Plagiarist, Impostor by R. Does not mention the recant. Lib Bailliere et fils,  Archives Internationales Claude Bernard,  Le Cas Pasteur" begins on page  I want to counter them. The germ theory states that the body is sterile and disease is caused by external germs microbes. The terrain â€" the internal environment â€" in response to various forces, fosters the development of germs from within. To my thinking, the germ theory essentially blames the messenger. This more detailed explanation is extracted from members. The body is sterile. Microbes exist naturally in the body. Disease arises from micro-organisms outside the body. Disease arises from micro-organisms within the cells of the body. Micro-organisms are generally to be guarded against. These intracellular micro-organisms normally function to build and assist in the metabolic processes of the body. The function of micro-organisms is constant. The function of these organisms changes to assist in the catabolic disintegration processes of the host organism when that organism dies or is injured, which may be chemical as well as mechanical. The shapes and colours of micro-organisms are constant. Micro-organisms are pleomorphic having many forms: Every disease is associated with a particular micro-organism. Every disease is associated with a particular condition. Micro-organisms are primary causal agents. Disease results when microbes change form, function, and toxicity according to the terrain of the host.

Hence, the condition of the host organism is the primary causal agent. Disease can "strike" anybody. Disease is built by unhealthy conditions. To prevent disease we have to "build defences. New Information New information refutes the germ theory: Bacteria and viruses have been found and identified in healthy people. The same bacteria and viruses that have been associated with disease have also been found in healthy people, where they apparently play a benevolent role.

## 5: Fermentation - Pasteur Brewing

*But before he was able to publish his germ theory of disease, there was an indirect contributor to the germ theory. This man was Edward Jenner, a country surgeon in the late eighteenth century who was born in Berkeley, England, nearly sixty years before Pasteur developed the germ theory of disease. 22 His major contribution to germ theory was that he was the first person in the records to make a vaccine against smallpox.*

We have also forgotten how rare it was for parents to see all of their children survive to adulthood. Still, it has been little more than a century and a half since Robert Koch made the discoveries that led Louis Pasteur to describe how small organisms called germs could invade the body and cause disease. In the final decades of the 19th century, Koch conclusively established that a particular germ could cause a specific disease. He did this by experimentation with anthrax. Using a microscope, Koch examined the blood of cows that had died of anthrax. He observed rod-shaped bacteria and suspected they caused anthrax. When Koch infected mice with blood from anthrax-stricken cows, the mice also developed anthrax. This led Koch to list four criteria to determine that a certain germ causes a particular disease. Can cause skin lesions cutaneous anthrax , breathing difficulties and shock inhalation anthrax , or severe vomiting and diarrhea gastrointestinal anthrax. Also refers to the cells grown, i. GERMâ€"A disease-causing organism, such as a bacteria, parasite, or virus, usually single celled. Overcoming Disease Until the 20th century, it was common to lose a child to disease. Smallpox, polio, diphtheria, whooping cough, tetanus, measles, and mumps maimed and killed thousands of children every year. But due to the development of vaccines, there has not been a single natural case of smallpox in the world since , polio has been eradicated in the Western Hemisphere, and whooping cough, tetanus, and mumps are rarely seen in developed countries. Smallpox causes blisters similar to chickenpox. Smallpox is easily spread through coughing or sneezing, or through contact with contaminated clothes or bed linen. Twelve and 14 days after exposure, the patient develops a fever with severe aches and pains. A rash then appears over the entire body including the palms of the hands and soles of the feet. Vaccination before exposure to smallpox prevents the illness. There is no known treatment; however, vaccination up to 5 days after the exposure may help to prevent death. Polio is caused by a virus that enters through the mouth and is easily transmitted from person to person, particularly between children during the summer months. It causes headache, fever, and aches before entering the bloodstream and infecting the nerves controlling movement. It can lead to suffocation and death caused by paralysis of the lung muscles. I long regretted bitterly, and still regret that I had not given it to him by inoculation [had his son vaccinated]. This I mention for the sake of parents who omit that operation, on the supposition that they should never forgive themselves if a child died under it; my example showing that the regret may be the same either way, and that, therefore, the safer should be chosen.

## 6: Germ theory | medicine | www.enganchecubano.com

*The Germ Theory of Disease. Before Pasteur disproved spontaneous generation, he decided to determine why some bottles of wine soured over time. He observed wine that had soured and compared it to.*

Fermentation Photograph of Louis Pasteur Louis Pasteur first devoted himself to the study of fermentation in , when he is approached by M. Bigo, a local industrialist in Lille, and asked for advice concerning the production of alcohol in beet juice. Apparently Bigo was experiencing large vats of beet juice turning sour instead of alcoholic as expected. Pasteur agreed to help with the problem and this began his first experiment in the area of fermentation. Pasteur visited the factory where the beet juice was being produced and observed the differences in some of the vats. He smelled the fermentation process in the first batch. In that specific vat, the juice smelled fine and the juice was clearly fermenting into alcohol. But in other vats the odor was sour and in some cases putrid. A thin layer of grime covered the top of the juice in these vats. This both puzzled and interested Pasteur and motivated him into looking at exactly what was going on during the fermentation process. Not only was this scientifically interesting, but solving this problem would save Bigo great deals of money from spoiled beet juice and would also do the local community a service. Some samples were of good fermentation and others of spoiled fermentation. When reviewing the samples of good fermentation with the microscope, he noticed nothing peculiar, just the usual yest cells that were known to be associated with fermentation. When Pasteur examined the samples of bad fermentation under the microscope, he noticed something different. Instead of yeast cells, there were many elongated, black rods. He proposed that these black rods were another form of microorganism that had infected the beet juice and overwhelmed the yeast cells. Pasteur developed an experiment that showed how these bacteria thrived in the beet juice and could quickly multiply, overtaking the substance. Furthermore, he showed that instead of producing alcohol as a bi-product, this specific form of bacteria produced lactic acid. By understanding that one small bacteria can multiply and take over the vat, Bigo must ensure that no bacteria enter the vat from the beginning. Spoiled vats must be cleaned and the juice disposed of properly. Louis Pasteur was seen as a local hero and continued his work on fermentation. While vacationing in Arbois with his family, Pasteur examines diseased wines and observes the presence of germs analogous to those found in lactic fermentation. His research would lead him to the discovery of anaerobic oxygen-deprived life and gave him the insight to disprove the theory of Spontaneous Generation, for which he receives the Prix Alhumbert in  Other important work followed that eventually leads to one of the greatest discoveries of mankind to date: All with its beginnings in fermentation.

## 7: Louis Pasteur - Wikipedia

*But it was the laboratory researches of Louis Pasteur in the s and then Robert Koch in the following decades that provided the scientific proof for germ theory. Their work opened the door to research into the identification of disease-causing germs and potential life-saving treatments.*

Registered nurses provide a wide variety of services to patients. They also work very closely with other medical professionals to diagnose patients and assist with treatment. Many of the discoveries of Louis Pasteur related to disease and germ theory revolutionized the nursing and surgical occupations. During the 19th century, much of the science that dictates medical procedure today was unheard of. Disease outbreak of cholera, typhoid, and even plague could claim the lives of hundreds overnight. Nurses spent much of their time trying to make patients comfortable rather than administering actual treatment. As the development of bacteriology and microbiology improved, medicine did too. Louis Pasteur was at the forefront of this field. With his knowledge of germ theory and the way bacteria spreads, he insisted they implement sterilization and bacterial prevention methods. Before Pasteur, it was commonly believed the wounds should be left exposed to the open air to dry out. Pasteur discovered that not only did this not help, but made the situation much worse. The bacteria floating in the air would land on the open wounds, causing infection. Many of the infected wounds would get out of control, requiring limbs to be amputated and even causing death. The first layer of care was immediate first aid. Washing the wounds, removing dirty clothing from the wounded area created a clearner space for nurses and surgeons. The next step was to ensure that any medical instruments that would touch the wound were properly sanitized before use. It was common practice to use instruments that had been laying around or previously used on another patient without being cleaned. The final step, after aid or surgery was complete, was to cover the wounds with a clean cloth to ensure no bacteria could get into the wound. By covering the wounds and using sterilized medical instruments, Pasteur was able to significantly improve the survival rate of wounded soldiers. These techniques became standard in hospitals and still taught in registered nurse programs today.

## 8: A Brief Summary of Louis Pasteur's Germ Theory of Disease

*This is the germ theory of disease. This theory led to the successful identification and treatment of many microbial diseases (1), saving millions of lives and contributing to the development of.*

His interest in science, and especially in chemistry, developed early, and by the time he was twenty-six he was professor of the physical sciences at Dijon. The most important academic positions held by him later were those as professor of chemistry at Strasburg, ; dean of the Faculty of Sciences at Lille, ; science director of the Ecole Normale Superieure, Paris, ; professor of geology, physics, and chemistry at the Ecole des Beaux Arts; Professor of chemistry at the Sorbonne, After he carried on his researches at the Pasteur Institute. He was a member of the Institute, and received many honors from learned societies at home and abroad. In respect of the number and importance, practical as well as scientific, of his discoveries, Pasteur has hardly a rival in the history of science. He may be regarded as the founder of modern stereo-chemistry; and his discovery that living organisms are the cause of fermentation is the basis of the whole modern germ- theory of disease and of the antiseptic method of treatment. His investigations of the diseases of beer and wine; of pebrine, a disease affecting silk-worms; of anthrax, and of fowl cholera, were of immense commercial importance and led to conclusions which have revolutionised physiology, pathology, and therapeutics. By his studies in the culture of bacteria of attenuated virulence he extended widely the practise of inoculation with a milder form of various diseases, with a view to producing immunity. The following papers present some of the most important of his contributions, and exemplify his extraordinary powers of lucid exposition and argument. The efforts which I have devoted to these Studies, as well as those which preceded them, are the fruit of thy counsel and example. Desiring to honor these filial remembrances, I dedicate this work to thy memory. I undertook them immediately after the war of , and have since continued them without interruption, with the determination of perfecting them, and thereby benefiting a branch of industry wherein we are undoubtedly surpassed by Germany. I am convinced that I have found a precise, practical solution of the arduous problem which I proposed to myself--that of a process of manufacture, independent of season and locality, which should obviate the necessity of having recourse to the costly methods of cooling employed in existing processes, and at the same time secure the preservation of its products for any length of time. These new studies are based on the same principles which guided me in my researches on wine, vinegar, and the silkworm disease--principles, the applications of which are practically unlimited. The etiology of contagious diseases may, perhaps, receive from them an unexpected light. I need not hazard any prediction concerning the advantages likely to accrue to the brewing industry from the adoption of such a process of brewing as my study of the subject has enabled me to devise, and from an application of the novel facts upon which this process is founded. Time is the best appraiser of scientific work, and I am not unaware that an industrial discovery rarely produces all its fruit in the hands of its first inventor. I began my researches at Clermont-Ferrand, in the laboratory, and with the help, of my friend M. Duclaux, professor of chemistry at the Faculty of Sciences of that town. I continued them in Paris, and afterwards at the great brewery of Tourtel Brothers, of Tantonville, which is admitted to be the first in France. I heartily thank these gentlemen for their extreme kindness. I owe also a public tribute of gratitude to M. Kuhn, a skillful brewer of Chamalieres, near Clermont-Ferrand, as well as to M. Velten of Marseilles, and to MM. It is observed, for instance, that fleshy fruits are not liable to fermentation so long as their epidermis remains uninjured. On the other hand, they ferment very readily when they are piled up in heaps more or less open, and immersed in their saccharine juice. The mass becomes heated and swells; carbonic acid gas is disengaged, and the sugar disappears and is replaced by alcohol. The principal products of these various fermentations, although resembling each other in their nature, differ in their relative proportions and in the accessory substances that accompany them, a fact which alone is sufficient to account for wide differences in the quality and commercial value of alcoholic beverages. Now that the discovery of ferments and their living nature, and our knowledge of their origin, may have solved the mystery of the spontaneous appearance of fermentations in natural saccharine juices, we may ask whether we must still regard the reactions that occur in these fermentations as phenomena inexplicable by the ordinary laws of chemistry. We can readily see that fermentations occupy a special place in the series of chemical and biological phenomena. What gives to fermentations certain exceptional characters of which we are only now beginning to suspect the causes, is the mode of life in the minute plants designated under the generic name of ferments, a mode of life which is essentially different from that in other vegetables, and from which result phenomena equally exceptional throughout the whole range of the chemistry of living beings. The least reflection will suffice to convince us that the alcoholic ferments must possess the faculty of vegetating and performing their functions out of contact with air. Let us consider, for instance, the method of vintage practised in the Jura. The bunches are laid at the foot of the vine in a large tub, and the grapes there stripped from them. When the grapes, some of which are uninjured, others bruised, and all moistened by the juice issuing from the latter, fill the tub--where they form what is called the vintage--they are conveyed in barrels to large vessels fixed in cellars of a considerable depth. These vessels are not filled to more than three-quarters of their capacity. Fermentation soon takes place in them, and the carbonic acid gas finds escape through the bunghole, the diameter of which, in the case of the largest vessels, is not more than ten or twelve centimetres about four inches. The wine is not drawn off before the end of two or three months. In this way it seems highly probable that the yeast which produces the wine under such conditions must have developed, to a great extent at least, out of contact with oxygen. No doubt oxygen is not entirely absent from the first; nay, its limited presence is even a necessity to the manifestation of the phenomena which follow. The grapes are stripped from the bunch in contact with air, and the must which drops from the wounded fruit takes a little of this gas into solution. This small quantity of air so introduced into the must, at the commencement of operations, plays a most indispensable part, it being from the presence of this that the spores of ferments which are spread over the surface of the grapes and the woody part of the bunches derive the power of starting their vital phenomena [Footnote: It has been marked in practice that fermentation is facilitated by leaving the grapes on the bunches. The reason of this has not yet been discovered. Still we have no doubt that it may be attributed, principally, to the fact that the interatices between the grapes, and the spaces between the bunch leaves throughout, considerably increase the volume of air placed at the service of the germs of ferment. This air, however, especially when the grapes have been stripped from the bunches, is in such small proportion, and that which is in contact with the liquid mass is so promptly expelled by the carbonic acid gas, which is evolved as soon as a little yeast has formed, that it will readily be admitted that most of the yeast is produced apart from the influence of oxygen, whether free or in solution. We shall revert to this fact, which is of great importance. At present we are only concerned in pointing out that, from the mere knowledge of the practices of certain localities, we are induced to believe that the cells of yeast, after they have developed from their spores, continue to live and multiply without the intervention of oxygen, and that the alcoholic ferments have a mode of life which is probably quite exceptional, since it is not generally met with in other species, vegetable or animal. Another equally exceptional characteristic of yeast and fermentation in general consists in the small proportion which the yeast that forms bears to the sugar that decomposes. In all other known beings the weight of nutritive matter assimilated corresponds with the weight of food used up, any difference that may exist being comparatively small. The life of yeast is entirely different. For a certain weight of yeast formed, we may have ten times, twenty times, a hundred times as much sugar, or even more decomposed, as we shall experimentally prove by-and- bye; that is to say, that whilst the proportion varies in a precise manner, according to conditions which we shall have occasion to specify, it is also greatly out of proportion to the weight of the yeast. We repeat, the life of no other being, under its normal physiological conditions, can show anything similar. The alcoholic ferments, therefore, present themselves to us as plants which possess at least two singular properties: These are facts of so great importance, and so intimately connected with the theory of fermentation, that it is indispensable to endeavour to establish them experimentally, with all the exactness of which they will admit. The question before us is whether yeast is in reality an anaerobian [Footnote: Capable of living without free oxygen--a term invented by Pasteur. The following experiments were undertaken to solve this double problem: We filled this flask with pure yeast water, sweetened with 5 per cent, of sugar candy, the flask being so full that there was not the least trace of air remaining above the tap or in the escape tube; this artificial wort had, however, been itself aerated. The curved tube was plunged in a porcelain vessel full of mercury, resting on a firm support. In the small cylindrical funnel above the tap, the capacity of which was from 10 cc. We then opened the tap, and some of the liquid in the funnel entered the flask, carrying with it the small deposit of yeast, which was sufficient to impregnate the saccharine liquid contained in the flask. In this manner it is possible to introduce as small a quantity of yeast as we wish, a quantity the weight of which, we may say, is hardly appreciable. The yeast sown multiplies rapidly and produces fermentation, the carbonic gas from which is expelled into the mercury. In less than twelve days all the sugar had disappeared, and the fermentation had finished. There was a sensible deposit of yeast adhering to the sides of the flask; collected and dried it weighed 2. It is evident that in this experiment the total amount of yeast formed, if it required oxygen to enable it to live, could not have absorbed, at most, more than the volume which was originally held in solution in the saccharine liquid, when that was exposed to the air before being introduced into the flask. Raulin in our laboratory have established the fact that saccharine worts, like water, soon become saturated when shaken briskly with an excess of air, and also that they always take into solution a little less air than saturated pure water contains under the same conditions of temperature and pressure. At a temperature of 25 degrees C. The three litres of yeast- water in the flask, supposing it to have been saturated, contains less than This was the maximum amount of oxygen, supposing the greatest possible quantity to have been absorbed, that was required by the yeast formed in the fermentation of grammes 4. We shall better understand the significance of this result later on. Let us repeat the foregoing experiment, but under altered conditions. Let us fill, as before, our flask with sweetened yeast-water, but let this first be boiled, so as to expel all the air it contains. To effect this we arrange our apparatus as represented in the accompanying sketch. We place our flask, A, on a tripod above a gas flame, and in place of the vessel of mercury substitute a porcelain dish, under which we can put a gas flame, and Which contains some fermentable, saccharine liquid, similar to that with which the flask is filled. We boil the liquid in the flask and that in the basin simultaneously, and then let them cool down together, so that as the liquid in the flask cools some of the liquid is sucked from the basin into the flask. From a trial experiment which we conducted, determining the quantity of oxygen that remained in solution in the liquid after cooling, according to M. NaHSO2, now called sodium hyposulphite. At the same time we conducted another experiment, by way of comparison Fig. We took a flask, B, of larger capacity than the former one, which we filled about half with the same volume as before of a saccharine liquid of identically the same composition. This liquid had been previously freed from alterative germs by boiling. In the funnel surmounting A, we put a few cubic centimetres of saccharine liquid in a state of fermentation, and when this small quantity of liquid was in full fermentation, and the yeast in it was young and vigorous, we opened the tap, closing it again immediately, so that a little of the liquid and yeast still remained in the funnel. By this means we caused the liquid in A to ferment. We also impregnated the liquid in B with some yeast taken from the funnel of A. We then replaced the porcelain dish in which the curved escape tube of A had been plunged, by a vessel filled with mercury. The following is a description of two of these comparative fermentations and the results they gave. Fig 2] [Illustration with caption: The impregnation took place on January 20th. The flasks were placed in an oven at 25 degrees 77 degrees F. The following days, fermentation was active. Examining the yeast mixed with the froth that was expelled into the mercury by the evolution of carbonic acid gas, we find that it was very fine, young, and actively budding. The yeast was at the bottom in the form of a deposit. The following days, fermentation was active, and there was an abundant froth on the surface of the liquid. As the fermentation in A would have continued a long time, being so very languid, and as that in B had been finished for several days, we brought to a close our two experiments on February 9th. To do this we poured off the liquids in A and B, collecting the yeasts on tared filters. Filtration was an easy matter, more especially in the case of A. Examining the yeasts under the microscope, immediately after decantation, we found that both of them remained very pure. The yeast in A was in little clusters, the globules of which were collected together, and appeared by their well-defined borders to be ready for an easy revival in contact with air.

## 9: How Pasteur Made Nursing Better - Pasteur Brewing

*Germ theory, in medicine, the theory that certain diseases are caused by the invasion of the body by microorganisms, organisms too small to be seen except through a microscope. The French chemist and microbiologist Louis Pasteur, the English surgeon Joseph Lister, and the German physician Robert Koch are given much of the credit for development and acceptance of the theory.*

The family moved to Marnoz in and then to Arbois in They were married on May 29, , [28] and together had five children, only two of whom survived to adulthood; [29] the other three died of typhoid. Career Pasteur in Pasteur was appointed professor of chemistry at the University of Strasbourg in , and became the chair of chemistry in The examinations became more rigid, which led to better results, greater competition, and increased prestige. Many of his decrees, however, were rigid and authoritarian, leading to two serious student revolts. During "the bean revolt" he decreed that a mutton stew, which students had refused to eat, would be served and eaten every Monday. On another occasion he threatened to expel any student caught smoking, and 73 of the 80 students in the school resigned. In , he became the chair of organic chemistry at the Sorbonne, [34] but he later gave up the position because of poor health. Then he observed that, in racemic mixtures of tartrates, half of the crystals were right-handed and half were left-handed. In solution, the right-handed compound was dextrorotatory , and the left-handed one was levorotatory. This was the first time anyone had demonstrated molecular chirality , and also the first explanation of isomerism. In a local wine manufacturer, M. Pasteur demonstrated that this theory was incorrect, and that yeast was responsible for fermentation to produce alcohol from sugar. Pasteur and Claude Bernard completed tests on blood and urine on April 20, He proposed preventing the entry of micro-organisms into the human body, leading Joseph Lister to develop antiseptic methods in surgery. In the first three years, Pasteur thought that the corpuscles were a symptom of the disease. The pulp was examined with a microscope, and if corpuscles were observed, the eggs were destroyed. The primary cause is currently thought to be viruses. Hygiene could be used to prevent accidental flacherie. Moths whose digestive cavities did not contain the microorganisms causing flacherie were used to lay eggs, preventing hereditary flacherie. These experiments were important pieces of evidence supporting the germ theory of disease. Following his fermentation experiments, Pasteur demonstrated that the skin of grapes was the natural source of yeasts, and that sterilized grapes and grape juice never fermented. He drew grape juice from under the skin with sterilized needles, and also covered grapes with sterilized cloth. Both experiments could not produce wine in sterilized containers. To settle the debate between the eminent scientists, the French Academy of Sciences offered the Alhumbert Prize carrying 2, francs to whoever could experimentally demonstrate for or against the doctrine. He placed boiled liquid in a flask and let hot air enter the flask. Then he closed the flask, and no organisms grew in it. The number of flasks in which organisms grew was lower at higher altitudes, showing that air at high altitudes contained less dust and fewer organisms. Air was allowed to enter the flask via a long curving tube that made dust particles stick to it. Nothing grew in the broths unless the flasks were tilted, making the liquid touch the contaminated walls of the neck. This showed that the living organisms that grew in such broths came from outside, on dust, rather than spontaneously generating within the liquid or from the action of pure air. There is no known circumstance in which it can be confirmed that microscopic beings came into the world without germs, without parents similar to themselves. He received cultures from Jean Joseph Henri Toussaint , and cultivated them in chicken broth. Upon reusing these healthy chickens, Pasteur discovered he could not infect them, even with fresh bacteria; the weakened bacteria had caused the chickens to become immune to the disease, though they had caused only mild symptoms. Chamberland failed to do this and went on holiday himself. On his return, the month-old cultures made the chickens unwell, but instead of the infections being fatal, as they usually were, the chickens recovered completely. Chamberland assumed an error had been made, and wanted to discard the apparently faulty culture, but Pasteur stopped him. Pasteur concluded that the animals were now immune to the disease. The chickens survived, and when he inoculated them with a virulent strain, they were immune to it. In , Pasteur presented his results to the French Academy of Sciences, saying that the bacteria were weakened by contact with oxygen. Pasteur cultivated bacteria from the blood of animals infected with anthrax. When he inoculated animals with the bacteria, anthrax occurred, proving that the bacteria was the cause of the disease. Pasteur thought that earthworms might have brought the bacteria to the surface. Pasteur thought that this type of killed vaccine should not work because he believed that attenuated bacteria used up nutrients that the bacteria needed to grow. He thought oxidizing bacteria made them less virulent. Pasteur agreed, and the experiment, conducted at Pouilly-le-Fort on sheep, goats and cows, was successful. Pasteur did not directly disclose how he prepared the vaccines used at Pouilly-le-Fort. Inoculation with smallpox variolation was known to result in a much less severe disease, and greatly reduced mortality, in comparison with the naturally acquired disease. A few months later, Koch wrote that Pasteur had used impure cultures and made errors. In , Pasteur replied to Koch in a speech, to which Koch responded aggressively. Then they passed the bacillus through rabbits, weakening it and obtaining a vaccine. Pasteur and Thuillier incorrectly described the bacterium as a figure-eight shape. Roux described the bacterium as stick-shaped in  One survived but may not actually have had rabies, and the other died of rabies. The first of the Pasteur Institutes was also built on the basis of this achievement. Anxious to secure a sample of saliva straight from the jaws of a rabid dog, I once saw him with the glass tube held between his lips draw a few drops of the deadly saliva from the mouth of a rabid bull-dog, held on the table by two assistants, their hands protected by leather gloves. Because of his study in germs, Pasteur encouraged doctors to sanitize their hands and equipment before surgery. Prior to this, few doctors or their assistants practiced these procedures. Controversies A French national hero at age 55, in Pasteur discreetly told his family never to reveal his laboratory notebooks to anyone. His family obeyed, and all his documents were held and inherited in secrecy. Yet the papers were restricted for historical studies until the death of Valley-Radot in  The documents were given a catalogue number only in  He regarded himself as the first to show the role of microorganisms in fermentation. With both scientists claiming priority on the discovery, a dispute, extending to several areas, lasted throughout their lives. His name was "associated with bygone controversies as to priority which it would be unprofitable to recall". In , Marcellin Berthelot isolated invertase and showed that succinic acid did not invert sucrose. Hans Buchner discovered that zymase catalyzed fermentation, showing that fermentation was catalyzed by enzymes within cells. Toussaint isolated the bacteria that caused chicken cholera later named Pasteurella in honour of Pasteur in and gave samples to Pasteur who used them for his own works. He used potassium dichromate to prepare the vaccine. He did not have any experience in medical practice, and more importantly, a medical license. This is often cited as a serious threat to his professional and personal reputation. He was not allowed to hold the syringe, although the inoculations were entirely under his supervision. He later disclosed his procedures to a small group of scientists. Pasteur wrote that he had successfully vaccinated 50 rabid dogs before using it on Meister. List of things named after Louis Pasteur In many localities worldwide, streets are named in his honor. For example, in the USA: The Avenue Pasteur in Saigon, Vietnam, is one of the few streets in that city to retain its French name. The sculpture was designed by Harriet G. Moore and cast in by Artworks Foundry. Pasteur Institute After developing the rabies vaccine, Pasteur proposed an institute for the vaccine. Pasteur" and "the study of virulent and contagious diseases". One year after the inauguration of the institute, Roux set up the first course of microbiology ever taught in the world, then entitled Cours de Microbie Technique Course of microbe research techniques. Since the Pasteur Institute had been extended to different countries, and currently there are 32 institutes in 29 countries in various parts of the world. Absolute faith in God and in Eternity, and a conviction that the power for good given to us in this world will be continued beyond it, were feelings which pervaded his whole life; the virtues of the gospel had ever been present to him. Full of respect for the form of religion which had been that of his forefathers, he came simply to it and naturally for spiritual help in these last weeks of his life.

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