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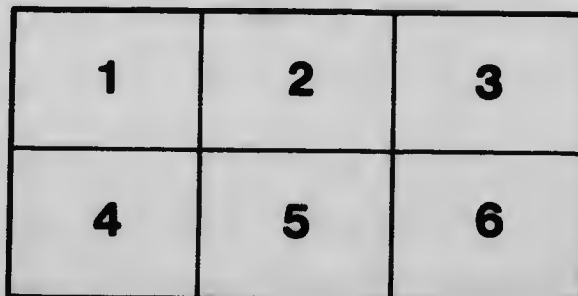
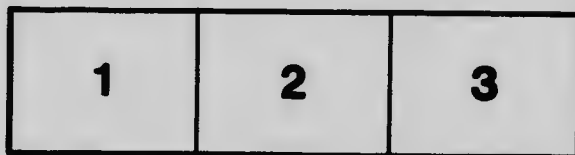
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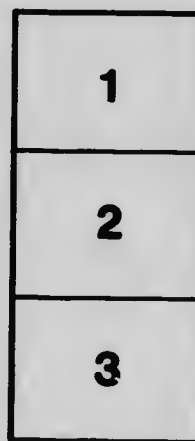
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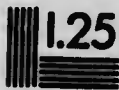
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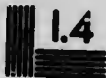
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LOUIS PASTEUR

THE GREAT FRENCH SCIENTIST

BY

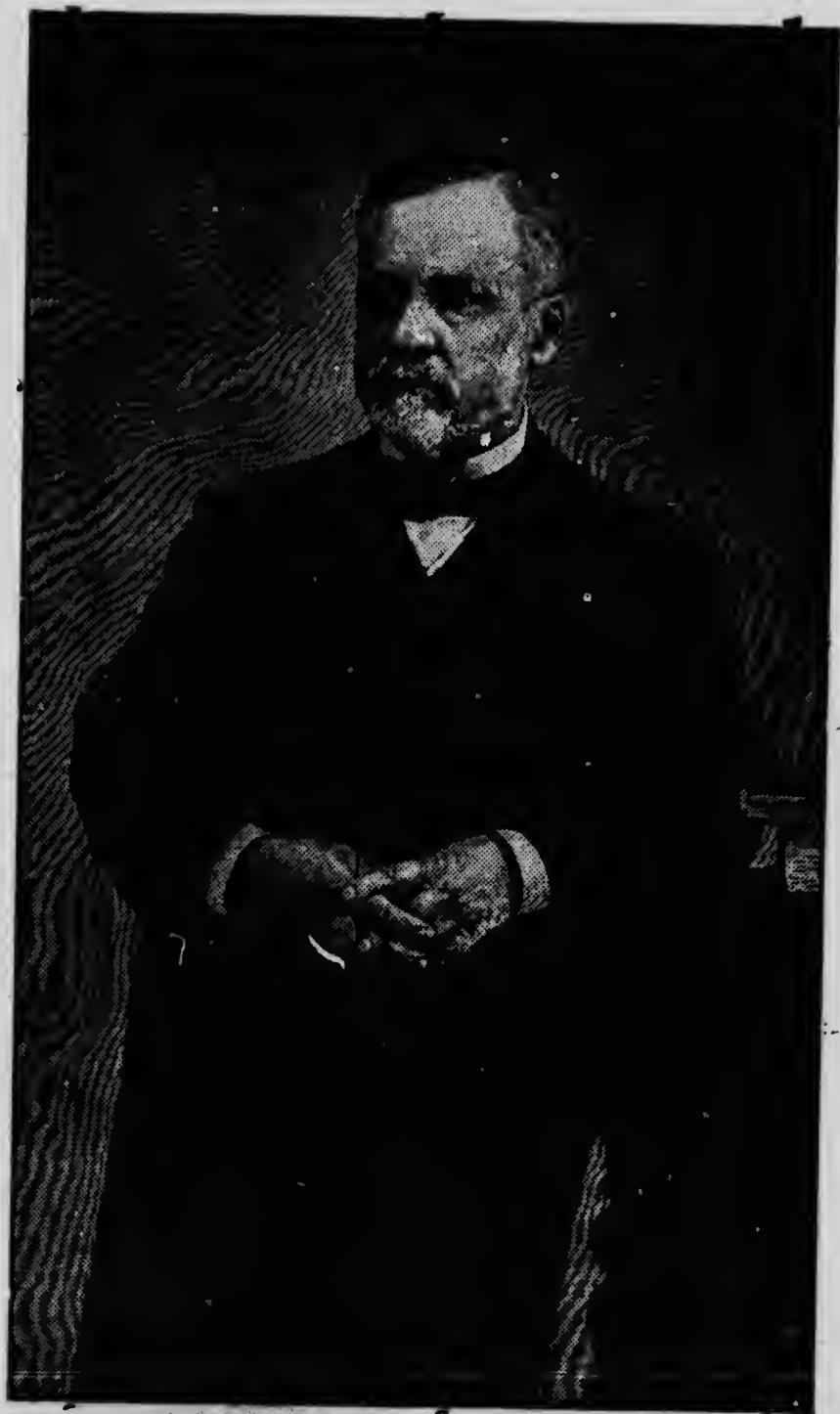
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NOVEMBER 6th, 1903





LOUIS PASTEUR 1822-95.



LOUIS PASTEUR

The Great French Scientist

His Marvellous Discoveries Described by Rev. Dr. Bryce,
President of the Manitoba College
Literary Society

A crowded audience filled Convocation Hall, Manitoba College, Friday evening, Nov. 6, to listen to an excellent programme of music and readings provided by the Literary Society. During the evening the inaugural address of the President, Rev. Dr. Bryce, for the College year 1903-4 was given. This was received with loud applause and is reported in full as follows:—

He prayeth well, who loveth well
Both man and bird and beast:
He prayeth best, who loveth best
All things both great and small.

Whatever Coleridge meant by these words in the closing lines of "The Ancient Mariner," we see a beautiful application of one phase of them in Louis Pasteur, the great Frenchman, who had a rare balance of head and heart.

In the painting by Donnât, where Pasteur stands with his young daughter nestling by his side, there is a picture of perfect happiness; and in the sketch by Roussard, the benevolent face of the great specialist, filled with unutterable pity, is portrayed bending over a little girl, a patient who had come from England to Paris to be treated by him for hydrophobia.

In these we see the man. Great as was the genius of Pasteur, his heart was his greatest endowment.

A genius he assuredly was. He had the power to see what the occasion required; with unerring eye he penetrated the secrets of nature as shown him by the microscope; with marvellous intellectual grasp he could leap over

steps of reasoning required by ordinary minds and put his finger upon the true sequence; with infinite industry he tested his methods and results to eliminate possible errors; with unwavering conviction, when he had reached his conclusion, he held to it and could not be moved; with unexampled enthusiasm he followed his various lines of study; and with impatient disregard for mere theory or pre-established custom he struggled with the strength of an intellectual giant, for the good of "man and bird and beast."

These are the marks of genius, but with it all there was the simplicity of a little child.

Born in the remote Jura—the Boeotia of France—Pasteur was unspolled by the artificialisms of his native land; the whole of his life he pursued by the clear light of truth his own path; unlike many of the world's reformers and benefactors he never failed to have his ideas appreciated; and struck by a



PASTEUR INSTITUTE, PARIS.

paralytic stroke before he had reached his fiftieth year it was pathetic to see him struggling on for well nigh a generation later, making discovery after discovery, until at the age of seventy-three he passed away in the last decade of his century.

To examine somewhat carefully the workings of a great soul like that of Pasteur's is certainly worth our while; it may be an inspiration to us; it may give an impetus to us, so that we may endeavor to make our lives sublime. Materials for such an investigation are plentiful, and we are greatly indebted to the admirable biography of the scientist by his son-in-law, M. Rene Valery-Radot; an appreciation of his work by Prof. Percy Frankland, of Mason College, Birmingham; a sympathetic critique by Professor Tyndall; and to some description of his discoveries by Lord Lister in his Presidential address before the British Association in Liverpool, in 1896.

Anticipations of Greatness

As a youth Louis Pasteur exhibited marked bents of character. The son

of a tanner of Arbois, his circumstances were not those of the poor, yet they required of him strenuous early efforts to fit himself for making a living by the education to which his father destined him. With his tender nature, which made the sight of a wounded lark painful to him, there was associated the fine artistic faculty, which led to his marked success, in crayon drawing, a taste seen in his producing a complete portrait gallery of notables of his town, which appealed to the wonder of the simple people of the Jura.

Louis Pasteur's father was an old soldier, who had fought for three years in Napoleon's army in Spain, and won the badge of the Legion of Honor. On the back of one of the inner doors of the tanner's house at Arbois was a picture drawn by the veteran himself, representing a soldier in an old uniform engaged in tilling the soil. The picture was an allegory of his life. Young Pasteur imbibed this soldier spirit, and a true son of the Jura, his imagination pictured the glories of "la belle France," and he was all his life an enthusiastic patriot. And yet with all this heroic virtue of patriotism Pasteur's heart was so tender, that on his being sent at sixteen to be educated in Paris, he pined with home sickness and declared: "If I could only get a whiff of the tannery yard, I feel I should be cured," until in very pity his father came to Paris to bring him home.

Easily the first at the college at Arbois, and in one year taking more prizes than he could carry, he found his ambitions reaching out for other fields to conquer. To Besancon, the capital of Franche-Comte, and only twenty-four miles from Arbois, accordingly he went, and to the Royal College there. He became thoroughly interested in the college work, and his spirit may be seen in a passage of a letter to his sisters: "Dear sisters, let me tell you again, work hard, love each other. When one is accustomed to work it is impossible to do without it; besides, everything in the world depends on that. Armed with science, one can rise above all one's fellows." At the age of eighteen young Pasteur was classified as "very good in elementary science." Here we have in germ the life, spent for more than fifty years afterward, of the most untiring and successful student and experimenter of his time.

A year after entrance the young eleven was raised to the grade of "preparation master," in the College at Arbois, and on a small salary. His outlook was wider now, and perhaps there is a spice of pedantry in his writing to his sisters: "Three things: Will, Work, Success, fill human existence. Will opens the door to success both brilliant and happy; Work passes these doors, and at the end of the journey Success comes to crown one's efforts." Pasteur's friendships and aspirations at Besancon were most fortunate. He met a sage of his own Franche-Comte—Joseph Droz—and his lofty ethics, and marked kindness and patience, both in his person and writings, influenced the youth very greatly.

In Besancon as supplementary master he received board and lodging and three hundred francs (\$60) a year—an enormous salary, thought Pasteur, and yet his modest reflection is, "I am not really worth it." Feeling that he was the only member of his family enjoying educational advantages, the young teacher offered to pay for the schooling of his sister, Josephine, proposing to give private lessons to accomplish the end in view. In reply to this his parents, on the other hand, offered to give him a small allowance a month to enable him to take private lessons in order that he might reach the goal of his and their ambition.

Was there ever a more beautiful example of domestic love and of self-sacrifice? As one of Pasteur's biographers has said: "Filiale pietas; brotherly

solicitude! friendly confidence!—Pasteur knew the sweetness of all these early human joys; the whole of his life was permeated by them. The books he loved added to this flow of generous emotion." Surely we approve these words; and thinking of his industry, artistic faculty, ingenuity and patriotism, see in the boy the father of the man!

Pasteur was ever, during his time of tutelage at Besancon, thinking of Paris—"Paris where," said he, "thinking is deeper." At twenty years of age he presented himself before the Dijon Faculty and was passed for entrance into the "Ecole Normale" at Paris. But the standing of nineteenth in the list dissatisfied him, and so going to one of the best Parisian schools for a year, he again passed, and this time stood fourth. Absorbed now in the study of Chemistry he made his first stroke of genius. Like Minerva, from the head of Jove, he became a fully armed and equipped investigator. The professor of Chemistry had merely described the method of making phosphorus. Pasteur obtained a quantity of bones, went through the chemical process, and obtained 60 grains of phosphorus. This was his first scientific ecstasy.

His friend Chappuis, like himself, a Franche-Comtian, and he walking in the gardens of the Luxembourg discussed a sentence of Mitscherlich, the Berlin chemist and crystallographer, that from the tartar found in wine barrels, there were two tartrates, seemingly the same in composition, but acting differently under polarized light. He had written two important essays for his professor, and a third was read before the Academie des Sciences. He saw in studying the tartrate crystals what no one had before noticed that on one class of them there were minute hemihedral faces, on the others none. Or applying the polarized light he was disappointed. A further examination showed him that there were mingled together as paratartrates a right and a left series of hemihedral crystals, which neutralized each other in the polariscope. He had made a great discovery. His excitement was intense. At this juncture the young chemist's mother died. He was for weeks unnerved. His work stopped.

The news of his discovery began to be whispered about. Prof. Biot, who for thirty years had worked at polarimetry, tested the experiments. Pasteur was right. The old man was overwhelmed at the sight and said: "My dear boy, I have loved science so much during my life that this touches my heart!" His fame at once spread, and with true French impulsiveness it was decided that a chair must be found for young Pasteur, and he was forthwith appointed Professor of Physics at Dijon Lycee. Shortly after he was promoted to the professorship of Chemistry at Strasburg, and here in a short time was married to the daughter of the Rector of the Academy, M. Laurent.

Determined to test the matter of the racemic or paratartratic acid to the furthest, like one of the aforesaid Alchemists, he went abroad to Germany on his quest. He went on to Vienna and also to Prague. He succeeded by ingenious methods in transforming tartaric acid into paratartratic, a thing held before to be impossible. His discovery came before the Academy of Sciences, and he was awarded the red ribbon of the Legion of Honor. He visited Arbois, his home, with the true ribbon of distinction, his given in the arts of peace, as his father's had been in the struggles of war. He received a prize of 1,500 francs, half of which he turned over to the Strasburg faculty, which was poor. In his discovery he had obtained the clue, to the long series of triumphs which he achieved in the department of fermentative changes.

Fermentation.

To Pasteur, who had received for his researches the Rumford medal from

the Royal Society of England, soon came another promotion. The government was establishing a great institution of Science at Lille, in the extreme north of France. Pasteur was made Dean of the College, and he rejoiced in the opportunities afforded by the industries of the neighborhood. The town of 160,000 inhabitants had many factories, dye-works, bleach fields, chemical works, sugar manufactories, and breweries. Students flocked by hundreds to the new school. Pasteur's aim was to make the institution practical, and helpful to these many industries. The modifications and results of Fermentation was a great field of research. It was not at all understood, even by the leaders of science. Dumas said: "The act of Fermentation is strange and obscure." Berzelius, the great Swedish chemist, said: "Fermentation is due to contact." By another it was declared to be "a catalytic force,"—which



PASTEUR AT WORK.

meant nothing. Liebig, the dean of German chemistry, said: "Chemical decomposition was produced by influence"—but this again explained nothing. These were the best guesses the age had been able to make.

Pasteur undertook to study lactic fermentation—the fermentation of sour milk. He saw in the liquid, with the microscope, little bodies of gray substance forming. He placed this gray substance in other liquids. The fermentation was thus continued. "The gray substance," said he, "is the ferment." Pasteur saw the lactic ferment bud and multiply as ordinary beer yeast would do. A living agent and its products were before him.

In the very thickest of these investigations Pasteur was removed by the government to the "Ecole Normale," in Paris, the very pole star of his boyish ambitions, but now as chief administrator and director of studies. The accommodation of the Parisian school was much inferior to that of Lille, but he manfully grappled with the difficulties. He now investigated alcoholic fermentation, and here again found, as he says, "the deduplication of sugar

into alcohol and carbonic acid is correlative to a phenomenon of life; an organization of globules."

The year 1859 was largely taken up with examining fermentation. Whence come these ferments, those microscopic bodies, those transforming agents, so weak in appearance, so powerful in reality? He saw some great outcome in the future. He wrote to his old friend Chappuis: "I am pursuing these studies on fermentation which are of great interest, connected as they are with the impenetrable mystery of Life and Death."

Spontaneous Generation.

Early in February, Pasteur read an important paper before the Academy of Sciences on the line of the alcoholic, lactic, and tartaric fermentations. The paper was highly appreciated.

A wider field was opening up to Pasteur. In a postscript of a letter to a friend he said: "Yesterday I presented to the Academy my researches on Spontaneous Generation. They seemed to produce a great sensation. More later." Pasteur was forced to deal with this subject in order to meet his opponents in the matter of fermentation. His antagonists fell back on "occult," "obscure," "indefinite causes." To overcome this he was forced to grapple with spontaneous generation, whose advocates dated back to the times of Aristotle, Lucretius, Virgil, Ovid and Pliny. Even in the 16th century Von Helmont gave a recipe to create mice. This was "to put dirty linen into a receptacle, together with a few grains of wheat or a piece of cheese." The conflict was now again on, and it was to be a battle royal.

Pasteur's warm friend, Biot, who clung to the old positions, advised him against entering the contest. "You will never find your way out," urged Biot. "I shall try," replied Pasteur, calmly.

The invention of the microscope in the end of the 17th century had been used to support spontaneous generation; for, said its supporters, by what other means could you explain the production from one body of a million descendants in forty-eight hours. The clubs and fashionable gatherings of Paris took up the question.

Years before this the Cardinal of Polignac had written a thesis favoring the ground now taken by Pasteur, and ending: "Everything in this world has its germ or seed." Prominent men in the church in the 18th century had divided on the subject. An English priest, named Needham, had championed "spontaneous generation"; an Italian clerical, Spallanzani opposed Needham. The Italian Jesuit had "sealed tubes hermetically, heated them strongly, and found no possibility of life being produced." Voltaire had taken the side of the Jesuit, and was against the possibility of "spontaneous generation." Now in the 19th century the question was still in suspense.

To force his side forward a daring scientist of Rouen, M. Pouchet, sent a note to the Academy of Sciences claiming that he could show "that animals and plants could be generated in a medium absolutely free from atmospheric air, and in which, therefore, no germ of organic bodies could have been brought by air."

Pasteur undertook a campaign, which lasted for four years, to show Pouchet to be wrong. He wrote to Pouchet that he feared his facts were not founded on "faultless exactitude."

Pouchet had friends and ardent supporters. Two of these, Joly and Musset, maintained that "they did not mean a creation out of nothing, but the production of a new organized being, lacking parents, and of which the primordial elements are drawn from ambient organic matter."

Pasteur answered the rhetoric of his opponents, by constructing little glass flasks, with long curved necks, making it more difficult for germs to enter by means of the air. Pasteur was slowly running down his opponents.

Then Pouchet said: "But how can germs be numerous enough to develop in every organic mixture? Such a crowd of them would produce a thick mist as dense as iron." The clubs and salons said there was something in Pouchet's question.

Pasteur redoubled his energy. He examined the air of cellars, but could find no absolutely sterile zone. Next year with seventy-three flasks he started for the mountain country. Twenty of his flasks he opened near his father's house at Arbois; then he went on to Salins; after that to Chamonix, in the higher Alps; twenty flasks were opened on the "mer de glace." In nineteen of them no change took place.

Pouchet, on the other hand, went to Sicily, to Etna, out to sea, and declared "he found air everywhere favorable to organic genesis." The French world now seemed largely against Pasteur's contention.

Pasteur (1861) maintained, after the most constantly repeated tests, his conviction that the ferments changing sugar, mannite, etc., into various acids were really "infusory animalculae," living and multiplying indefinitely, without requiring any air. We know that his expression "infusory animalculae" was incorrect, still he was moving in the right line. Pasteur's friends unwisely brought up his name as a candidate for membership in the Academy of Sciences. But though defeated, he was elected in the following year.

Now Pasteur's positions began to gain ground. An attempt was made to have the question settled by a Commission of the Academy, but this failed.

After years of repose, the question broke out in 1877, when Dr. Bastian, an English physician, took ground in favor of spontaneous generation. Pasteur went over the old ground, the more that the question was now more of a medical one, viz., the spontaneity of all diseases. John Tyndall, the English scientist, came to the aid of Pasteur and their joint opinion gave this doctrine its quietus, since which time it has not revived.

Silkworm Disease.

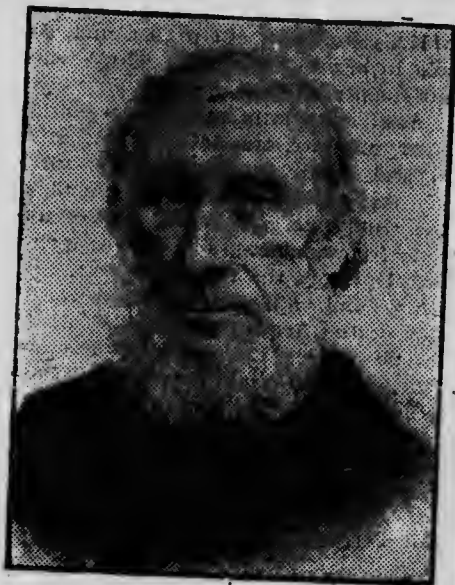
In 1864 Pasteur delivered a lecture on the subject of the contest. Shortly afterward the great experimenter was asked by Senator Dumas to undertake the study of a question of great moment to France and other countries of the south of Europe. A request had come from the town of Alais. No less than thirty-five hundred proprietors asked for a study of the disease among silkworms, which was ruining their industry. Pasteur replied that he had never touched a silkworm, but he would test the matter. This trade in silk in Pasteur's youth was valued at twenty millions of dollars. Italy, Spain and other countries were suffering in like manner. The mulberry tree, on which the worms fed, was called the Tree of Gold, on account of the rich returns of this industry.

This destructive disease was not understood. Corpuscles appeared on the silkworms, the spots being like pepper grains, and hence the name given in the patois of the country "pobre" or pepper disease. On investigation Pasteur found every imaginable remedy being tried: sulphur, charcoal, mustard meal, ashes, soot, quinine powder; washing, syringing, fumigation, but all without avail. The worms languished, many died; of the survivors the moths were diseased and deformed. Bad seed (eggs) was the cause of the disease. The people were in despair.

Pasteur soon said that the disease must be cut off at its source. Only

seed from healthy moths should be used. Two peasants brought him five healthy moths. Nothing could be done till the following spring. Then the critics opened fire. "He knows," said they, "nothing about silkworms. He is but a chemist." Pasteur only replied: "Have patience."

In the spring he bred sixteen broods of healthy worms. He had succeeded. But no! In the sixteenth disease was found. He was stunned, but not discouraged. He found a second disease—"facherie." "Now," said he, "we must go further back. The disease must be acquired at the time of reproduction. It is in the egg. The seed is to be examined carefully by the microscope. The diseased eggs must be smothered, the healthy preserved and used.



JOHN TYNDALL, 1820-93.



LORD LISTER.

Now the scientific genius had succeeded. Greed, ignorance, and individual interest still opposed him, but the battle was won. In France, Italy, Austria, and elsewhere large nurseries (magnaneries) were built, girls trained to use the microscope rejected the diseased seed, and in time the silkworm industry was completely restored.

The loss in France and Italy by the silkworm disease in the thirteen years preceding Pasteur's investigation was nearly six hundred millions of dollars. Who can estimate the value to his country of the single-minded scientist?

French Wines.

At the close of Pasteur's great battle with Pouchet the noted scientist had his attention called to the diseases of wines, wine production being one of the greatest industries of his native country. "Might not," said he "these be caused by 'organized ferments, microscopic vegetations'—which made acid wines, bitter wines, ropy wines, sour wines, etc. His native town of Arbois had offered to build Pasteur a laboratory for studying the wine disease. This

he refused, but he investigated the disease notwithstanding. After various attempts and failures to destroy the vitality of the parasitic germs which he found, he hit upon a very simple expedient, quite satisfactory to himself of raising the wines to a temperature of from 120 degrees to 140 degrees F., which quite destroyed the ferment. This simple remedy was, however, received with bitter opposition and contempt. Pasteur bided his time.

Having finished his silkworm investigation, the busy experimenter turned to the matter of the wines again. A commission had in the meantime been making tests in connection with it. Two half barrels of wine were treated: one being raised to 140 degrees F., the other not. The two were placed on board a vessel at Brest and sent to sea. In ten months the ship returned, and the first sample of wine was found sweet, the other sour. A larger experiment was then undertaken. The French frigate "La Sibyllie" went on a voyage round the world, carrying a full cargo of wine, which had been raised to 140 degrees F. The experiment was completely successful. How much this meant to France may be seen in the fact that about this time France produced annually one and a quarter billions of gallons of wine.

At this juncture a dark cloud fell upon the life of the great scientist. At the age of forty-six he was attacked by a stroke of paralysis, arising from over-work and anxiety in his experiments. Against this he fought valiantly, and although he suffered much pain, his life was prolonged for the good of humanity for twenty-seven years longer.

Service to Brewers.

Having laid his native land under contribution to him in so many ways Pasteur turned his mind to the improvement of the breweries, believing that the beverages of a people largely influence their health. In addition German beer was much better than French beer, and Pasteur was nothing if not a patriotic Frenchman.

M. Payen, a member of the French Institute, had written a work on the "Improvement and preservation of food." In this work referring to the alterations in beer he had spoken of "spontaneous alternations." The doughty knight who had vanquished the spontaneous generation theory was on his old battle ground again. Pasteur visited the breweries at Chamalieres, and, on investigation, found that quite frequently in summer beer becomes "acid and even putrid and unfit to drink." In this there was much loss. After this visit Pasteur went over to London and examined a brewery that produced no less than two and a fifth millions of gallons in a year. With his thorough scientific method, he investigated every corner and detail of the place. With microscope he examined every sample. Looking at a quantity of porter he found in it a noxious ferment, and throwing it upon a sheet of paper remarked: "That is poor porter." The proprietors confessed that that very morning they had been compelled to obtain new yeast. Pasteur found other micro-organisms foreign to the nature of the true beer yeast. On a visit to the brewery a week later Pasteur saw a microscope being employed and the spurious yeasts being rejected. Gradually Pasteur found his methods being followed in the breweries of his native land. Pasteur had now reached the positions: 1. Ferments are living beings. 2. There is a special ferment corresponding to each kind of fermentation. 3. Ferments are not produced spontaneously. The single minded genius had risen another step on the ladder of fame.

Antiseptic Medicine.

The Franco-German war crushed the heart and soul of France. The

patriotic Pasteur was completely broken: but the enormous death rate among the wounded, arising from ignorant and careless medical methods stirred up the scientist to action. A Dr. Guerin suggested that "the cause of purulent infection may perhaps be due to the germs or ferments discovered by Pasteur to exist in the air." Acting on this supposition Dr. Guerin washed the wounds of the injured with carbolic acid, and kept out the air from them, covering them with cotton wool and this with linen bandages.

The general opinion of the doctors had been that "purulent infection was an almost Divinely instituted consequence of any important operation," yet Guerin by his method succeeded in saving nineteen out of thirty-four patients to the amazement of the whole profession. Pasteur, taking great interest in this experiment, visited the different hospitals, and saw his opinions being vindicated.

It delighted the humane man of science to receive in 1874 a letter from Sir Joseph Lister, from which we make an extract: My Dear Sir:

"I do not know whether the records of British surgery ever meet your eye. If so, you will have seen from time to time notices of the antiseptic system of treatment, which I have been laboring for the last nine years to bring to perfection.

"Allow me to take this opportunity to tender you my most cordial thanks for having, by your brilliant researches, demonstrated to me the truth of the germ theory of putrefaction, and thus furnished me with the principle upon which alone the antiseptic system can be carried out.

"Believe me, etc.,

JOSEPH LISTER.

Note.—Lister's method, as is well known, was in operating on wounds to disinfect with carbolic acid instruments, sponges, hands, all dressings, and the wounds being operated on.

The Germ Theory of Disease.

Thus, in one way and another did the report of the discoveries made by the vigorous and alert minded Frenchman gain currency. Few problems are of greater interest to the public mind than that of the public health, and the occurrence and danger of infectious disease. The public men of France saw the great value of his discoveries, even before the experimenter himself saw it.

Pasteur's line of investigation was leading directly to the question of how to deal with diseases in men and animals. "There are," it was declared, "germs of microscopic organisms on the surface of all objects in the atmosphere and in water."

Dr. Davaine, a French physician, had applied the principle to medicine in 1863. In 1873 the matter was fully discussed. Pasteur referred back to his cultures of *Bacillus anthrax* and showed that this was the germ of the disease Anthrax or Murrain, also called Splenic Apoplexy, known from the earliest times in all lands among animals, wild or domestic—among cattle, sheep and swine. He showed how it was propagated. He demonstrated by his thorough experimental method its effect on hens.

In March, 1878, the Academy of Medicine assembled to hear the discussion between M. Colin, an opponent and Pasteur. The scientist maintained that no organic matter, unless it contained germs of anthrax, would produce the bacteria of anthrax. Colin denied every position of Pasteur, and among other things said it was possible to give anthrax to hens. Pasteur to show

Colin's ignorance, asked him to produce before the Academy a hen suffering from anthrax. This Colin was unable to do. Pasteur then showed that the reason of this was the high temperature of birds, which is about 107 degrees F. Then by lowering the temperature of a hen to 100 degrees, by immersing it in a cold bath, and placing it under the influence of the germs the splenic fever resulted. The Academy again gave their favorite unstinted applause.

Further justifying Pasteur's theory came the alarming mortality caused by puerperal fever in the maternity hospitals of Paris and elsewhere. In one year in one Parisian hospital 310 out of 1,350 patients perished. To women of the lower classes going to this institution, it was said that this hospital was the vestibule of death. One day when this subject was being discussed in the Academy of Sciences, one of Pasteur's colleagues was enlarging eloquently upon the various causes of the epidemic. The practised scientist arose and said, "It is none of these things which causes the outbreak; it is the nursing and medical staff who carry the microbes. The orator replied that he feared the microbe of this disease would never be found. Pasteur went to the blackboard, drew a diagram of the chain-like organism and said: "There—that is what it is like." Thus again did the germ theory gain an emphatic impetus.

His Greatest Discovery.

An epidemic of chicken cholera in 1880 excited the notice of Pasteur. In experimenting he found that in his cultures in flasks containing diseased portions, the microbes sown without an interruption of more than twenty-four hours in new fowls held all their virulence; but when the culture was kept for several weeks the hens on being inoculated, became ill, but recovered. If then new culture were administered to the same fowls they were found to be immune or unaffected by the deadly germs. His explanation was that the oxygen of the air weakened the microbe when for a time exposed. The microbe usually survived, but was harmless. The similarity of this experiment to the vaccine of Jenner was very striking.

But, asked Pasteur, is this general? What about the virulent anthrax? Can it be subdued in this way?

One of the difficulties in experimenting was that liquids which suit some microbes for growth are entirely unsuitable to others. A wide spread and long-continued examination and treatment of the microbe of anthrax was then given by the scientist. Wavering betwixt hope and fear he at last succeeded in obtaining the antidote for the disease in the weakened anthrax.

His statement was:—

1.—Artificial attenuation of virus, i. e., by the oxygen of the air weakens and abates the virulence of disease.

2.—Inoculation by this attenuated virus makes the patient immune.

This was undoubtedly the greatest discovery made by Pasteur, and the subsequent discoveries of other investigators, by which in the same manner the terrors of Diphtheria have been removed, justify us in awarding to the French scientist for this the brightest gem in his crown of honor.

A Famous Experiment.

We have seen already that while Pasteur was of a most sympathetic and kindly disposition, yet there was in him a fiery Gallic spirit which rejoiced in the heat of conflict. His desire to see his benevolent schemes succeed made him impatient of opposition. Accordingly, every one of his great discoveries

was won at the point of the bayonet. His panacea of vaccination by attenuated virus drew forth the opposition and derision of many opponents. One of these, M. Reassignol, veterinary surgeon of Melun, half in sport and half in earnest, published in his journal in 1881:—

"Will you have some microbe? There is some everywhere. Microbiolatriy is the fashion, it reigns undisturbed; it is a doctrine which must not even be discussed, especially when its Pontiff, the learned M. Pasteur, has pronounced the sacramental words, 'I have spoken.' The microbe alone is and shall be the characteristic of a disease; that is understood and settled; henceforth the germ theory must have the precedence of pure clinics; the microbe alone is true, and Pasteur is its prophet."

Melun Agricultural Society made a challenge to Pasteur to come to them and prove his theory. He accepted the glove thrown down. The society would supply the experimenter with sixty sheep. Twenty-five of them would be vaccinated with attenuated anthrax virus; twenty-five not. In ten or twelve days the twenty-five would again be vaccinated with the weakened virus. In two or three weeks the whole fifty—vaccinated and unvaccinated, would be inoculated with some very virulent anthrax culture. Most of the unvaccinated sheep Pasteur prophesied would die. If those who thus died were buried in an enclosure and next year twenty fresh sheep were put to graze in a pasture of this enclosure a number of them would die of anthrax.

It was a daring trial for Pasteur. Some of his experiments might fail; but as was said of Napoleon, so it could be spoken of him, "he liked hazardous games, with a character of grandeur and audacity."

The trial was to be begun on the 5th of May, and a crowd of people was present at Melun. His opponents were confident of his failure. The animals were vaccinated as agreed. Pasteur then gave an eloquent lecture on the whole subject. The second vaccination was duly made. On May 31st the inoculation with the dangerous virus took place.

The time expired on the 5th of June. On that day the party again assembled at Melun.

Twenty-three unvaccinated sheep were dead; the two others were dying. The twenty-five vaccinated sheep were in perfect health.

Did truth ever have a more complete vindication?

"No success," says his biographer, speaking of this, "has ever been greater than his."

Hostile Medicine.

Pasteur was a pure scientist and not a physician. When in 1878 he was elected a member of the Academy of Medicine, it was only by a majority of one vote. The medical profession, like all professions, has always in it unprogressive and narrow men. There were men in this Academy, who a few days before, had declared that the study of physiology can be of no practical use in medicine. In this society, Villemin, in 1885, a modest experimenter, ventured to say that tuberculosis is a disease which reproduces itself. He was regarded as an Esculapean anarchist. A famous surgeon of the Academy spoke in contempt of "laboratory surgery, which has destroyed many animals, and saved very few human beings." The same medical obscurantist spoke in contempt, what has really turned out to be a prophecy: "Typhoid fever, bacterization Hospital miasma, bacterization."

From one half of the Academy Pasteur's reception was decidedly cold; but with the ardor of his earnest and truthful nature he proceeded on a systematic plan of missionary work, and a few years brought about a large acceptance of his principles. The Journal of Medicine said: "He is not a medi-

cal man, and yet guided by his genius, he opens new paths across the most arduous studies of medical science.

Dr. Sedillot, an Alsatian, to whom belongs the honor of originating the word "microbe," said of the discoveries of our great magician: "We have seen the conceptions and birth of a new surgery, a daughter of science and art, which will be one of the greatest wonders of our century, and with which the names of Pasteur and Lister will remain gloriously connected."

We have lived to see this fulfilled, and as the result in almost every department, medicine from being a mere system of empiricism has become in the last twenty-five years a science.

Hydrophobia.

To the majority of civilized people Pasteur's name is best known as the apostle of the cure of hydrophobia. The terrible nature of the disease no doubt added to this interest, but his method of meeting it was but the outcome and development of his discovery in connection with chicken cholera anthrax. After experimenting on dogs he found the presence of the microbe most largely in the brain of the rabid dog, though also in the saliva. He then proceeded to act upon the virus by inoculation without interruption on a chain of as many as a hundred rabbits, and obtained a fixed virus. This was suspended in air and the microbes thus weakened. Vaccination with this would produce immunity from the dreaded disease. He had mastered the problem as was shown afterwards by a commission of the Academy. In the year 1888, President Carnot inaugurated the Pasteur Institute in Paris for the cure of Hydrophobia. This has proved a boon to the whole civilized world.

The True Man.

After reciting his wonderful discoveries, which made him a saviour of life and property, witnessing his election to be one of the "Forty Immortals" of the French Academy, and observing the widespread celebration of the 70th birthday of Pasteur, to recount the honors heaped upon him from all quarters would be "to paint the lily" or "to gild fine gold." His works follow him.

While we admire the honesty and candor of the great scientist, yet it is with pain we see him after the siege of Paris, when he saw his country bleeding and torn, decide to return his diploma of Doctor of Medicine received a number of years before from the German University of Bonn; and again, while respecting him, we are saddened to see Pasteur refuse from the Kaiser William of Germany, the badge of the Order of Merit. Like Victor Hugo he could not forgive the wrong as he saw it of consenting to the wrenching of Alsace and Lorraine from his native land.

The Christian.

Scientist, independent thinker, intellectual pugilist, and severe patriot as he was, there was in Pasteur a deeply religious spirit. While undemonstrative and reticent even to his intimate friends on sacred things, he had deep reverence, and held to all the institutions of the religious life of his native country. At the great funeral in Notre Dame the hierarchy, the government, societies of learning, science and art, and the people were all there to admit that:

"He bought, with price of purest breath,
A grave among the eternal."

As a scientist he claimed absolute liberty of research; but his spiritual sentiment caused him to claim for the inner moral life the same liberty. He

admitted conscience to be the vicegerent within him of the Supreme Being. He could not understand superficial men "who are in no wise moved by the Infinite Power, who created the worlds." He was convinced that there are no vain prayers, and he was a firm believer in the immortality of the soul. His love of home, of his wife, and his children was a remarkably strong principle or sentiment in him.

Ending a life of great determination and usefulness, which from the time of his paralytic stroke had been often one of great pain, he passed away at his house in Villeneuve l'Etang, near Paris—passed away, we are told, with an unspeakable expression of resignation and love in his face; one of his hands was resting in that of his wife, and the other grasped a cross in token of his faith.

MORE IMPORTANT

Works of Dr. Bryce

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