BÉCHAMP OR PASTEUR?

A LOST CHAPTER IN THE HISTORY OF BIOLOGY

PASTEUR: PLAGIARIST, IMPOSTOR

THE GERM THEORY EXPLODED

"If I could live my life over again, I would devote it to proving that germs seek their natural habitat, diseased tissue – rather than being the cause of the diseased tissue."

– *Rudolph Virchow*

"Nothing is lost, nothing is created ... all is transformed. Nothing is the prey of death. All is the prey of life."

– *Antoine Béchamp*

"The specific disease doctrine is the grand refuge of weak, uncultured, unstable minds, such as now rule in the medical profession. There are no specific diseases; there are specific disease conditions."

– *Florence Nightingale*

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ETHEL DOUGLAS HUME

prefaced by

Pasteur: Plagiarist, Impostor

The Germ Theory Exploded

R.B. PEARSON

A DISTANT MIRROR

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A Lost Chapter in the History of Biology
by Ethel Douglas Hume
was first published in 1923.

Pasteur: Plagiarist, Impostor
The Germ Theory Exploded
by R.B. Pearson
was first published in 1942.

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BOOK ONE

Pasteur: Plagiarist, Imposter

by R. B. Pearson

BOOK TWO

Béchamp or Pasteur?

A Lost Chapter in the History of Biology

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A Note from the Publisher

This volume contains new editions of two books which have been available only sporadically in the decades since their publication.

R. Pearson's *Pasteur: Plagiarist, Imposter* was originally published in 1942, and is a succinct introduction to both Louis Pasteur and Antoine Béchamp, and the reasons behind the troubled relationship that they shared for their entire working lives.

Whereas Pearson's work is a valuable introduction to an often complex topic, it is Ethel Douglas Hume's expansive and well-documented *Béchamp or Pasteur? A Lost Chapter in the History of Biology* which provides the main body of evidence. It covers the main points of contention between Béchamp and Pasteur in depth sufficient to satisfy any degree of scientific or historical scrutiny, and it contains, wherever possible, detailed references to the source material and supporting evidence. Virtually no claim in Ms Hume's book is undocumented – to have access to more material, one would need to be able to read French, and go to the original source material.

The reader will soon discern that neither Mr Pearson nor Ms Hume could ever be called fans of Pasteur or his 'science'. They both declare their intentions openly; that they wish to contribute to the undoing of a massive medical and scientific fraud. The publication of this present edition of their work is undertaken with complete empathy for that intention.

The text of both books has been comprehensively re-edited – for style more than content – the intention being to make for easier reading than the style of language used in the first half of the twentieth century would otherwise allow. I hope that the end result is an improvement, and that the authors would approve. I think they would.

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Author's preface

Many years ago in New York, Dr. Montague Leverson chanced to come upon the writings of Professor Antoine Béchamp. So greatly did he become imbued with the views of the French scientist that he seized the first opportunity to travel to Paris for the purpose of making the latter's acquaintance. Leverson arrived some months before Béchamp's death, and was able to receive from him in person an account of his discoveries and his criticisms of science, both ancient and modern.

After attending in Paris in 1908 the funeral of Professor Béchamp, Dr. Leverson found his way again to England. A year or two later I had the pleasure of making his acquaintance. We were both speakers at a meeting arranged by Lady Kathleen Bushe.

Dr. Leverson was still full of vigour; so much so that a little later, aged 80, he married for the second time. His enthusiasm for Antoine Béchamp was exceeded only by his detestation of Pasteur. He talked much to me about *microzymas*, but without explaining what was meant by this term. It was therefore incumbent on me to find out for myself.

I went to the reading room of the British Museum and sent for my long-suffering friend, Mr. R. Stretfeild.

"Have you ever heard of a French biologist, Professor Antoine Béchamp?" I asked him.

"Never", he answered. "These are all works on biology. I am afraid that is all I can do to help."

He left me standing in front of a row of large volumes on a main shelf. As though impelled by some external agent, I stretched out my arm and withdrew one. I opened it at random. On the page before me I saw the name *Béchamp*. My search was ended the moment it had begun. From that one short reference to the great Frenchman I was enabled to investigate further and discover that *microzymas* are the cell granules observed by many cytologists.

After some days of study, I put the results together in the form of an article. This I lent to Dr. Walter R. Hadwen, who then wrote on the subject in a subsequent issue of *The Abolitionist*, a magazine he edited. I, however, was dissatisfied with my first treatment of the matter, and entirely rewrote my treatise, which, under the title *Life's Primal Architects*, was accepted for publication in *The Forum*. It was afterwards

reproduced in *The Homoeopathic World*, and translated into Spanish for *Hispania*, a South American periodical.

The late Mr. Arnold Lupton, at one time Liberal Member of Parliament for Sleaford in Lincolnshire, then asked to be allowed to publish it as a pamphlet. In this form it ran through a couple of editions.

In 1915, I had an invitation from Mr. Lupton to attend with him and his wife, as his guest, the meetings of the British Association in Manchester. I was delighted to accept. Time passed quickly. It was not until the morning of the day of departure that Mr. Lupton made known the real purpose of his kind hospitality.

Without seeing it, he had promised to publish a work on Béchamp by Dr. Leverson. On receiving the typescript he found that this would be impossible because of the state it was in, and so he asked me to edit it. In the circumstances it was difficult for me to refuse, although I, too, was in ignorance of the nature of the proposed task. When the manuscript reached me, I found that it was little more than a jumble of quotations, chiefly from Béchamp's writings, without any references.

"There is no book to edit," I was forced to tell Mr. Lupton. "The book has still to be written."

He pressed me to carry out the work.

Immediately, a divergence of opinion arose with Dr. Leverson. He wished an account to be given of what he termed a 'fake experiment' by Pasteur. Both Mr. Lupton and I considered Pasteur's misdemeanours to be of less consequence than Béchamp's achievements, except where the two had bearings one on the other, so the 'fake experiment' was left out, which vexed Dr. Leverson. He asked for his manuscript to be returned, along with most of the books that he had lent me. I kept a few that were essential for my purpose, and sent off the rest together with his manuscript, which had been in my keeping for only a few weeks and which I never saw again.

I had secured for myself Béchamp's works from Paris, and, at my request, the authorities in the Department of Printed Books bought and included the same in the Library of the British Museum, where they continue to be available.

After naming the work on which I was engaged *Béchamp or Pasteur? A Lost Chapter in the History of Biology*, my first efforts were concentrated on acquiring details about Béchamp's life. A long correspondence followed with his relations, and finally, from his son-in-law, Edouard Gasser, I obtained all the particulars that are included in the introductory chapter of this book.

A thorough examination of the reports of the meetings of the French Academy of Science was my next task. In this I was greatly helped by the kindness of the British Museum authorities, who put at my disposal a long table in the North Library, where the massive volumes of the *Comptes Rendus* were allowed to remain until I had done with them.

When I came to the end of my work, I read it through with Mr. Lupton, who made some helpful criticisms. The manuscript was also submitted to Mr. Judd Lewis, who checked the scientific matter and kindly enabled me to see the workings of the polarimeter, the instrument of which, in his investigations, Béchamp made such great use. In another laboratory I was shown under the microscope the different stages of *Karyokinesis*.

All this occurred while World War I was raging. The period was unsuitable for publication. My manuscript was relegated to the bottom of a trunk, while I married and went to live in Scotland. For the moment my mind was distracted from Professor Béchamp.

Eventually, on my return to England, I rewrote the whole book; indeed I redid a great part of it for a third time. Then came tiresome business arrangements, in which I could not have done without the help of my husband. As my *Life's Primal Architects* had already, without reference to me, been made use of as a chapter in an American work on therapeutics, it seemed necessary for *Béchamp or Pasteur?* to be published in the United States for the sake of obtaining the American copyright.

At last, in 1923, the first edition appeared. Dr. Leverson, though still alive, was past knowledge of the event. When the first two thousand copies were sold, Mr. Lupton was eager for a second edition. This came into being not long after his death in 1930. A few days before his end I was privileged to see him. Never shall I forget the wonderful blessing he bestowed upon me for my pains. I shall always be grateful to him for forcing upon me an attempt that has succeeded far better than I would have dared to hope.

My gratitude also goes out to others most kind in their assistance, particularly to Her Grace, Nina, Duchess of Hamilton and Brandon.

Much encouragement has come from Béchamp's own country. First and foremost from Dr. Paul Chavanon, author of *Nous les ... Cobayes* and other eminent medical books. He is anxious that *Béchamp or Pasteur?* should be translated into French. The book also met with high approval from Dr. Gustave Rappin, Director of the Pasteur Institute of Nantes. As a young man he was present at the stormy sessions of

the Academy of Science, when Pasteur thundered at all who dared to oppose his views. The subsequent investigations of Dr. Rappin confirmed him in his strong support of the opinions of Béchamp. Gustave Rappin died during the Second World War at the age of 92.

Ethel Douglas Hume

1.
Introduction

Antoine Béchamp

At Villeneuve l'Etang, not far from Paris, on the 28th September, 1895, the death took place of a Frenchman who has been acclaimed as a rare luminary of science, a supreme benefactor of humanity. World-wide mourning, national honours, pompous funeral obsequies, lengthy newspaper articles, tributes public and private – all attended the passing of Louis Pasteur. His life has been fully recorded; statues preserve his likeness; his name has been given to a system, and institutes that follow his methods have sprung into being all over the world. Never has Dame Fortune been more prodigal with bounties than in the case of this chemist who, without ever being a doctor, dared nothing less than to profess to revolutionise medicine. According to his own dictum, the testimony of subsequent centuries delivers the true verdict upon a scientist, and, adopting Pasteur's opinion as well as, in all humility, his audacity, we dare to take it upon ourselves to search that testimony.

What do we find?

Nothing less than a lost chapter in the history of biology, a chapter which it seems essential should be rediscovered and assigned to its proper place. For knowledge of it might tend, firstly, to alter our whole understanding of modern medicine and, secondly, to prove the outstanding French genius of the nineteenth century to have been actually another than Louis Pasteur!

For indeed this astonishing chapter *denies* the prevalent belief that Pasteur was the first to explain the mystery of fermentation, the cause of the diseases of silkworms, and the cause of vinous fermentation; moreover, it shows that his theories of micro-organisms differed in basic essentials from those of the observer who seems to have been the real originator of the discoveries to which Pasteur has always laid claim.

And so, since Truth is our object, we venture to ask for patient and impartial consideration of the facts that we shall bring forward regarding the life-work of two French scientists, one of whom is barely known to the present generation, though much of its knowledge has been derived from him, while the name of the other has become a

household word.

Twelve and a half years after the death of Pasteur, on 15th April, 1908, there passed away in a modest dwelling in the student quarter of Paris an old man in his ninety-second year. His funeral was attended by a platoon of soldiers, for the nonagenarian, Professor Pierre Jacques Antoine Béchamp, had a right to this honour, as he had been a Chevalier of the Legion of Honour. Otherwise, the quiet obsequies were attended only by the dead man's two daughters-in-law, several of his grandsons, a few of his old friends and an American friend.[1] No pomp and circumstance in the last ceremonies indicated the passing of a great scientist, but, after all, it was far from the first time that a man's contemporaries had neglected his worth. Rather more than a century earlier another Antoine, whose surname was Lavoisier, had been done to death by his countrymen, with the comment:

> "The Republic has no need of savants!"

And now, with scant public notice, was laid in its last resting place the body of perhaps an even greater scientist than the great Lavoisier, since this other Antoine, whose surname was Béchamp, seems to have been the first clear exponent of the fermentative mysteries and the pioneer of authentic discovery in the realm of microscopy.

In the year in which he died, eight pages of the *Moniteur Scientifique* were required to set forth a list of his scientific works. To list his titles gives an idea of the stupendous labours of his long career:

— Master of Pharmacy.

— Doctor of Science.

— Doctor of Medicine.

— Professor of Medical Chemistry and Pharmacy at the Faculty of Medicine at Montpellier.

— Fellow and Professor of Physics and of Toxicology at the Higher School of Pharmacy at Strasbourg and Professor of Chemistry of the same town.

— Corresponding Member of the Imperial Academy of Medicine of France and of the Society of Pharmacy of Paris.

— Member of the Agricultural Society of Hirault and of the Linnaean Society of the Department of Maine et Loire.

1. Dr. Montague R. Leverson.

— Gold Medallist of the Industrial Society of Mulhouse (for the discovery of a cheap process for the manufacture of aniline and of many colours derived from this substance).

— Silver Medallist of the Committee of Historic Works and of Learned Societies (for works upon the production of wine).

— Professor of Biological Chemistry and Dean of the Faculty of Medicine of Lille.

Honorary Titles

— Officer of Public Instruction.

— Chevalier of the Legion of Honour.

— Commander of the Rose of Brazil.

Long though his life was, it can only seem incredibly short when compared with a list of discoveries phenomenal for the lifespan of one man. And as both the history of the foundations of biology and the work of Louis Pasteur are both intricately connected with this extended career, we will now sketch an outline of the life story of Antoine Béchamp.

He was born during the epoch that had just seen the finish of the Napoleonic wars, on 16th October, 1816, at Bassing, in Lorraine, where his father owned a flour mill. The boy was only eleven when a change in his life occurred. His mother's brother, who held the post of French Consul at Bucharest, paid the Béchamps a visit and was struck by the intelligence and aptitude of young Antoine. He grew anxious to give him better opportunities than he would be likely to meet with in his quiet country home. We have not heard much of Antoine's mother; but when we find that his parents unselfishly allowed him, for his own good, to be taken away from them at the early age of eleven, we may be fairly certain that she was a clever, far-seeing woman, who might perhaps confirm Schopenhauer's theory that a man's mother is of more importance to him than his father in the transmission of brains! Be that as it may, when the uncle's visit ended, the small nephew went with him, and the two undertook together the long and, in those days, arduous coach journey from Nancy to Bucharest.

It thus came about that the young Antoine saw much of the world and gained a thorough knowledge of a fresh language, advantages that strengthened and developed his intellect. Unfortunately, his kind uncle died after a few years, and the boy was left to face the battle of life alone.

Friends came to his aid, and placed him as assistant to a chemist, who allowed him to attend classes at the University, where his brilliance made all learning easy; and in 1833, without any difficulty, he obtained a diploma in pharmacy.

(In his youthful proficiency he presents a contrast to Pasteur, who in his schooldays was pronounced to be only an average pupil, and later, by an examiner, to be mediocre in chemistry.)

Antoine was still under twenty when he returned to his native land and, after visiting his parents, started work at a chemist's in Strasbourg, which at that time, along with the rest of Alsace and Lorraine, was part of France.

His extraordinary powers of work were soon made manifest. Much of his spare time was devoted to the study of his own language, in which he acquired the polish of style that was to stand him in good stead in his future lectures and literary labours. All the while he continued his University course at the Academy of Strasbourg, until he became qualified as a chemist. On obtaining his degree he set up independently at Benfield in Alsace, where he met and married Clementine Mertian, the daughter of a retired tobacco and beet-sugar merchant, who made him a capable wife. Science claimed so much of her husband's time that the training of their four children and the whole management of the household were left almost entirely to Mme. Béchamp.

Soon after the marriage, Antoine returned to Strasbourg to set up as a chemist; but this work did not nearly satisfy his vigorous energy, and he now prepared himself to occupy a Professor's chair. He soon realised his aim. In a short time he acquired the diplomas of Bachelor of Science and Letters and of Doctor of Medicine, and was nominated Professor at the School of Pharmacy in the Faculty of Science, where for a time he took the place of his colleague Pasteur.

These notable rivals both worked in the full flush of early enthusiasm in the capital of Alsace. But a difference already marked their methods. Pasteur seems never to have left an effort of his unrecorded; every idea as to the tartaric and racemic acids, with which he was then occupied, appears to have been confided to others; letters detailed his endeavours; his invaluable patron, the scientist Biot, was especially taken into his confidence, while his approaching honour and glory were never allowed to absent themselves from his friends' minds. He wrote to Chappuis that, on account of his hard work, he was

> "...often scolded by Mme. Pasteur, but I console her by telling her that I shall lead her to fame." [1]

From the start, Antoine Béchamp was utterly indifferent to personal ambition. Never of a pushing temperament, he made no effort to seek out influential acquaintances and advertise his successes to them. Self-oblivious, he was entirely concentrated upon nature and its mysteries, never resting till something of these should be revealed. Self-glorification never occurred to him, and while the doings of Pasteur were being made public property Béchamp, shut in his laboratory, was immersed in discoveries which were simply published in scientific records without being heralded by self-advertisement.

The work that he accomplished at Strasbourg was prolific in benefits for France in particular and for the world at large. It was there that his studies led him to the discovery of a new and cheap method of producing aniline, which up to 1854 had been so costly as to be useless for commercial purposes. The German chemist August Wilhelm von Hofmann, who for many years carried on work in England, after investigating the results of earlier discoveries, produced aniline by subjecting a mixture of nitro-benzene and alcohol to the reducing action of hydrochloric acid and zinc. Béchamp, in 1852, showed that the use of alcohol was unnecessary, and that zinc could be replaced by iron filings, also that either acetic or hydrochloric acid may be used.[2]

By thus simplifying and cheapening the process he conferred an enormous benefit on the chemical industry, for the cost of aniline fell at once to 20 francs and later to 15 francs a kilogram; while, moreover, his invention has continued in use to the present day. It is still the foundation of the modern method of manufacture in the aniline dye industry, which has been all too much appropriated by Germany. The *Maison Renard*, of Lyons, hearing of Béchamp's discovery, applied to him and with his help succeeded in a cheap production of fuchsin, or magenta, and its varieties. The only return made to Béchamp, however, was the award, ten years or so later, of a gold medal from the Industrial Society of Mulhouse.

Neither does any recognition seem to have been made to him for his discovery of a compound of arsenic acid and aniline, which, under the name of atoxyl, is used in the treatment of skin diseases and of sleeping sickness.

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1. *The Life of Pasteur*, René Vallery-Radot, p.58.
2. Confirmed in Richter's *Organic Chemistry* and in Thorpe's *Dictionary of Applied Chemistry* (1921).

Another work of his that was to prove especially prolific in results was his application of polarimetric measurements to his observations on the soluble ferments. The polarimeter, the instrument in which light is polarised or made to vibrate in one plane by means of one Nicol prism and examined by means of a second Nicol prism, was utilised by him in experiments, the general results of which were that he was enabled before any other worker to define and isolate a number of ferments to which he was also the first to give the name of *zymases*. In dealing with this work later on we shall show how his discovery, and even its nomenclature, has been attributed to somebody else.

So interminable were Béchamp's labours, so numerous his discoveries, that it is hard to know which to single out. He studied the monobasic acids and their ethers, and invented a method of preparing the chlorides of acid radicles by means of the derivatives of phosphorus. He made researches upon lignin, the characteristic constituent of the cell walls of wood cells, and showed clearly the difference between the substituted organic nitro-compounds, like ethyl nitrite and the nitro-paraffins. As we shall see subsequently, he was the first really to establish the occurrence in, and distribution by, the atmosphere of micro-organisms, such as yeast, and to explain the direct agent in fermentation to be the soluble ferment secreted by the cells of yeast and other such moulds. Cleverest of chemists and microscopists, he was also a naturalist and a doctor, and gradually his chemical work led him on to his astonishing biological discoveries.

The explanation of the formation of urea by the oxidation of albuminoid matters and his clear demonstrations of the specificity of the latter formed part of the strenuous labours that led to his opinion that the 'molecular granulations' of the cells assist in fermentation, that some are autonomous entities, the living principle, vegetable and animal, the originators of bodily processes, the factors of pathological conditions, the agents of decomposition – while, incidentally, he believed them to be *capable of evolving into bacteria.*

These conclusions may not all yet be adopted, but as so many of Béchamp's other teachings have come, through the independent work of some and the plagiarisms of others, to be generally accepted, it is certainly reasonable to hope that his amazing conception of Nature's biological processes will advance further discovery; and we wish to ensure the recognition of its legitimate parentage.

He showed that the cell must no longer be regarded (as was Virchow's view) as the fundamental unit of life, since it is built up by

the cell-granules within it. He was, it seems, the first to draw attention to the union of these same cell-granules, which he called *microzymas*, and to the rod-like groupings that result, which now go by the name of *chromosomes*. He laid great stress upon the minuteness of his microzymas, and from his teaching we can well infer his agreement with the belief that myriads must be ultra-microscopic, although he had far too exact a mind to descant in modern airy fashion upon matters that are purely conjectural. Where he exhibited his practical genius was that, instead of drawing fancy pictures of primeval developments of chromatin, he endeavoured to trace the actual building up of cells from the 'molecular granulations', that is, *microsomes*, or microzymas.

It was never his method to draw conclusions except from a sure experimental basis.

It was while Béchamp was undertaking his researches upon fermentation, at the very time that he was engaged upon what was to become part of his *Beacon Experiment*, that he was called from Strasbourg to Montpellier to occupy the Chair of Medical Chemistry and Pharmacy at the University there.

The period that followed seems to have been the happiest of his life. Filling an important position, he carried out his duties with the utmost distinction, his demonstrations before students gaining great renown.

He had already made and was further developing extraordinary discoveries which were attracting attention both in and beyond France. These gained him the devoted friendship of his future collaborator, Professor Estor, a physiologist and histologist who combined the duties of physician and surgeon at the Montpellier Hospital. Béchamp, also, had the advantage of medical training, and though he never practised as a doctor, his pathological studies were continuous and he was daily in touch with the work of physicians and surgeons, such as Courty as well as Estor, and he himself took full advantage of the experience to be obtained in hospital wards. His and Estor's more theoretical studies were checked and enlarged by their intimacy with the vast experiments that Nature carries out in disease. Both men were accustomed to the strictness of the experimental methods of Lavoisier, and their clinical and laboratory work progressed side by side, the one confirming and establishing the other.

Without ever neglecting his professorial duties, sufficiently arduous to absorb the whole time of any ordinary mortal, Béchamp laboured incessantly, both by himself and with Professor Estor, at his researches.

A small band of pupils gathered around, helping them, while far into the night the two enthusiasts constantly worked, often, as Béchamp tells us,[1] quite awestruck by the wonderful confirmation of their ideas and verification of their theories.

Such toil could only be continued by one possessed of Professor Béchamp's exuberant health and vitality, and it possibly told upon Professor Estor, whose early death was attributed partly to his disappointment that the popular germ theory of disease, in all its crudity, should have seized public attention instead of the great microzymian doctrine of the building up of all organised matter from the microzymas, or 'molecular granulations' of cells.

His incessant work, which kept him apart from his family, was the only hindrance to Béchamp's enjoyment of a happy domestic life. An excellent husband and father, he was always thoughtful towards others, and in all his dealings was as kind as he was firm. His lectures were made delightful by his easy eloquence and perfect enunciation, no less than by the clearness of his reasoning; while his social manner possessed grace and courtliness. Well above medium height, his clear eye and ruddy complexion gave unstinted proof of the perfect sanity of mind and body that he was blessed with throughout the whole course of his long life.

To the physiognomist, a comparison of the looks of the rivals, Béchamp and Pasteur, gives a key to their respective scientific attitudes. Alert determination is the chief characteristic of Pasteur's features; intellectual idealism of Béchamp's.

Pasteur approached science from the commercial, that is to say, the utilitarian standpoint, no less self-advantageous although he professed to benefit the world.

Béchamp had the artist's outlook. His thirst was for knowledge, independent of profit; he longed to penetrate the unexplored realms of Nature's secrets; the outer world was forgotten. It never occurred to him to indite compliments to influential acquaintances and announce at the same time the dawning of a new idea. The lessons he learned in his quests he duly noted and communicated to the French Academy of Science and at first ignored the fact that his observations were pirated. When finally his silence changed to protest, we shall see, as we proceed, that his patience had been stretched to snapping point. Himself so exact in his recognition of every crumb of knowledge owed to another, he could only feel contempt for pilferers of other men's ideas, while

1. *La Théorie du Microzyma*, A. Béchamp, p.123.

his exuberant vigour and energy fired him with uncompromising opposition to those who, not content with reaping where he had sown, trampled with their distortions upon a harvest that might have been so abundant in results.

It was during the years spent at Montpellier that his open rupture came with Pasteur, on account, as we shall see further on, of the latter's appropriation of Béchamp's explanation of the causes of the two diseases that were then devastating silkworms and ruining the French silk industry. There was no escaping the fact that Pasteur's opinions on the subject had been erroneous until Béchamp had provided the proper solution, yet no voices were raised in condemnation of the former's methods. Pasteur had already gained the ear of the public and acquired Imperial patronage. In all ages, the man of influence is a hard one to cross swords with, as Béchamp was to find.

But at Montpellier he had not yet drained the cup of life's bitterness. Hope still swelled high for the future, especially when, as time passed, a new assistant rose up, and Béchamp's elder son, Joseph, became a sharer in his work. This young man, whose lovable character made him a general favourite, took at an early age his degree in science, including chemistry, besides qualifying as a doctor. It seemed certain that he would some day succeed his father at the University.

But for France a sad day was dawning, and for Béchamp a disastrous change in his career. The year 1870 saw war with Prussia, and the humiliation of France. The districts of Alsace and Lorraine, the home of Béchamp's young boyhood and early manhood, were lost to Germany.

A longing stirred to show that, though despoiled of territory, France could yet dominate the world of thought. So it came about that, as an intellectual stimulus, universities were founded in different places under ecclesiastical patronage. It was hoped that the Church of Rome might hold sway over mental activities.

Lille was one such centre, and about the year 1874 Béchamp was invited to take the post there of Dean of the Free Faculty of Medicine. Some wise friends advised him not to leave Montpellier; but, on the other side, he was bombarded with entreaties to take up work at Lille. Finally, and due entirely to patriotic motives, he allowed himself to be persuaded to leave the University of Montpellier, and its happy memories of successful work. His altruistic wish to benefit both France and science brought about his acquiescence in the change. He moved to the north with his son Joseph, the latter having been appointed Professor of Toxicology at Lille.

All might have gone well had it not been for the clerical directors at Lille. They failed to understand Béchamp's teaching or their implications. They were apprehensive of the novelty of views that in reality were lamps, with which religious faith could have illuminated the mysteries of creation. Still in the dark as to these, the anxious prelates protested against the Professor's exposition of the microzymas, the infinitesimal cellular granules now known as *microsomes*, or *microzymes*, which he considered to be the formative agents of the cells that constitute all forms, both animal and vegetable.

It was tragic that his ground-breaking conception of Nature's processes should have been regarded not as a torch of enlightenment but rather as a dangerous fuse to start a conflagration. In Béchamp was seen a man who dared to investigate Nature's methods, instead of complacently resigning them to hackneyed formula.

Pasteur, however, seems never to have fallen foul of the ecclesiastical authorities; partly, perhaps, because he did not come into the same close contact, but also because, with his worldly wisdom, he was content to profess leadership in science and discipleship in religion; besides, had he not also gained influential patronage?

Béchamp's deep insight had taught him the connection between science and religion – the one a search after truth, and the other the effort to live up to individual belief. His faith had widened to a breadth incomprehensible to those who even suggested the appointment of a Commission to recommend the placing on the Roman Index of his book *Les Microzymas*, which culminates in the acclamation of God as the Supreme Source. Béchamp's teachings are in direct opposition to materialistic views. But his opponents had not the insight to see that the Creator is best demonstrated by understanding the marvels of Creation.

Impatient of petty bickerings, like most men of high intellect, Béchamp found himself more and more at a disadvantage in surroundings where he was misinterpreted and misunderstood. Nor were these his only worries. He was suffering from the jealousy he had inspired in Pasteur, and was smarting from the latter's public attack on him at the International Medical Congress in London, which they had both attended in 1881. Such behaviour on the part of a compatriot before a foreign audience had seared the sensitive spirit of Béchamp and motivated him to reply to Pasteur's plagiarisms. As he writes in the preface to *Les Microzymas*:[1] 'The hour to speak has come!'

1. p.8.

Another hour was soon to strike for him. After enduring for about eleven years the prejudices and persecutions of the Bishops and Rectors of Lille, he felt unable to continue to submit to the restraints placed on his work. No cause of complaint could be upheld against him; the charge of materialism in his views could not be supported; but rather than have his work continually hampered, Béchamp regretfully decided to send in his resignation, and his son Joseph, for his father's sake, felt impelled to do the same. Thus father and son, the shining lights of Lille's educational circle, found their official careers cut short and experienced that bitterness of spirit understood only by those whose life has been their work.

The younger Béchamp during his stay at Lille had married a Josephine Lang from Havre, and, owing to this new connection, the Béchamp family moved to the seaboard town and set up in business as chemists. A scientific laboratory enabled the two strenuous workers to undertake medical analyses and continue their research.

But again the hand of Fate dealt heavily with Antoine Béchamp. His son Joseph, well known as a clever chemist, was constantly employed in making chemical assays, and this work occasionally took him out to sea. On one of these expeditions he caught a severe chill. Double pneumonia set in, and in a few days ended his comparatively short and most promising life of 44 years.

It was Antoine Béchamp's sad lot to outlive his wife and his four children. Quite against his wishes, his younger daughter had been persuaded into taking the veil, and the severity of life in a convent caused her death at an early age. His elder daughter had married, at Montpellier in 1872, a M. Edouard Gasser, who owned vineyards in Remigny, and left five children, one daughter and four sons, one of whom was at an early age carried off by typhus, while the other three lived to do service for France in World War I.

Joseph Béchamp left six children, four daughters and two sons, one of whom died young. The other son had no taste for science, and disposed of his father's pharmacy and laboratory. He died a bachelor in 1915.

Antoine Béchamp's younger son, Donat, who died in 1902, married a Marguerite Delarue, and left three sons, the two younger of whom were destined to lay down their lives in the Great War. The eldest, then a doctor in the Russian Army, narrowly escaped death by drowning through the sinking of the hospital ship *Portugal* by a German submarine. Sole living male representative of his grandfather, he is

said to inherit the same genius. Without the least effort he has taken diplomas in medicine, chemistry and microscopy, and with the same facility has qualified in music and drawing, the arts being as easy to him as the sciences.

We now return to Antoine Béchamp at the point where we left him at Havre, suddenly bereft of the gifted son on whom not only his family affections but his scientific hopes were placed. Antoine Béchamp was indeed experiencing the rigorous discipline of which the Chinese philosopher Mencius speaks:

> "When Heaven demands of a man a great work in this world, it makes his heart ache, his muscles weary, his stomach void and his mind disappointed; for these experiences expand his heart to love the whole world and strengthen his will to battle on where others fall by the way."

Havre had become a place of sorrowful memories, and Professor Béchamp was glad to move to Paris. Here he could continue his biological work in the laboratory of the Sorbonne, generously put at his disposal by his old colleague, M. Friedel, who with another old friend, M. Fremy, had never ceased to deplore his patriotic unselfishness in abandoning his great work at Montpellier.

Up to 1899, that is to say, until he was 83 years of age, this grand old man of science never ceased his daily labours in the laboratory. After that time, though no longer able to continue lab work, he worked no less diligently to within a few days of his death, collecting and arranging the literary results of his long years of toil, while he continued to follow and criticise the course of modern science.

Up to the very end, his brilliant intellect was undimmed. Patriarchal in dignity, he was always ready to discuss old and new theories and explain his own scientific ideas. Though sorrow and disappointment had robbed him of his natural cheerfulness, he was in no sense embittered by the lack of popular recognition. He felt that his work would stand the test of investigation, that gradually his teaching would be proved true and that the verdict of coming centuries could not fail to raise him to his proper place. Even more indifferent was he to the lack of riches. For him, labour was its own reward, and success was defined by the results of work and not by financial profit, which as often as not falls to the share of plagiarists and charlatans, at the expense of men of real worth.

And so, in 1908, came the April day when, worn out by labour, Antoine Béchamp could no more rise from his bed. His belief was proved, to quote his own words,[1] in Him 'whom the founders of science, the greatest geniuses that are honoured by humanity from Moses to our own day, have called by the name God!'

"My faith!" was one of his last whispered utterances as his life ebbed away; and of faith he was well qualified to speak, he who had delved so deeply into Nature's marvels and the mysteries of the invisible world. Calm and confident to the end, his trust was immovable.

Well does the *Moniteur Scientifique* predict that time will do justice to his discoveries and that once the living actors have passed from the stage and impartial judgment brought into play, Béchamp's genius will be revealed to the world.

He taught that which was marvellous and complex, like all Nature's workings, and public ignorance snatched instead at what was simple and crude. But error, having the canker of destruction within itself, falls to pieces by degrees.

Already the need arises for a saner solution to disease than the mere onslaughts of venomous microbes and a fuller explanation of the processes of biological growth and disruption, of life and death.

And to whom should the world go, rather than to the inspirer of what was correct in Pasteur's teaching, the true revealer of the mystery of fermentation, the exponent of the role of invisible organisms, the chemist, naturalist, biologist and physician – Professor Antoine Béchamp?

1. *Les Microzymas*, A. Béchamp, p.926.

PART 1

THE MYSTERY OF FERMENTATION

2.
A Babel of Theories

Before starting any examination of the contributions of Béchamp and Pasteur to the scientific problems of their age, it may be well to consider the utter confusion of ideas then reigning in the scientific world in regard to the mysteries of life and death, and to the phenomenon of fermentation.

This chapter will give a quick outline of the absence of clarity surrounding these leading questions; and though the work of earlier scientists invariably led up to subsequent discovery, yet in the days when Antoine Béchamp and Louis Pasteur commenced their work, the understanding of the subject was, as we shall see, in a state of confusion.

Three paramount problems faced scientific inquirers of the time:

1. What is living matter, this 'protoplasm' (so-called from Greek words meaning *first* and *formed*)? Is it a mere chemical compound?
2. How does it come into being? Can it arise spontaneously, or must it always be derived from pre-existing life?
3. What causes matter to undergo the change known as 'fermentation'?

Among Professor Béchamp's prolific writings, much discussion may be found of the confused babel of theories on these subjects.

To start with the first question:

What is living matter?

There was merely the vague explanation that protoplasm is the living matter from which all kinds of living beings are formed and to the properties of which all are ultimately referred.

There was belief in a substance called *albumen*, best represented by the white of egg, which was said to mix with certain mineral and other matters without changing its nature. J. Dumas demonstrated that such 'albuminoids' comprise not one specific thing, but many different bodies; but the contrary opinion prevailed, and for such

substances 'protoplasm' was adopted as a convenient term.

It was 'the physical basis of life', according to Huxley; but this hardly illumined the difficulty, for to pronounce protoplasm to be living matter *per se* was not to explain the mystery of *how* it was so, or its origin and composition. True, Huxley further declared all living matter more or less to resemble albumen, or white of egg; but this latter was also not understood by either biologists or chemists.

Charles Robin regarded it as being of the type of the mucoids – that is to say, as resembling mucus, which itself was so shrouded in mystery that Oken called it *Urschleim* (primordial slime), and the botanist Hugo Mohl identified it with protoplasm, thus dignifying mucus as the physical basis of all things living!

Claude Bernard tried to determine the relation of protoplasm to organisation and life, and combated the general idea that every living body must be morphologically constituted, that is to say, have some structural formation. He argued that protoplasm gave the lie to this belief by its own structural indefiniteness. Charles Robin followed the same view, and gave the name of *blastéme*, from the Greek word meaning *to sprout*, to the supposed primordial source of living forms.

This was nothing but the old idea of living matter, whether called *protoplasm* or *blastéme*. A cell, a fibre, a tissue – any anatomical element – was regarded as living simply because of its formation by this primordial substance. Organisation was said to be its 'most excellent modification'.

In short, formless matter was supposed to be the source of all organised living forms. In a kind of despair of any experimental demonstration of organisation and life, a name was invented for a hypothetical substance magically alive, although structurally deficient. Imagination played more part in such a theory than deduction from tangible evidence. Thus we find that the physician Bichat, who made a name for himself in science before he died in 1802, at the early age of 31, could not accept such an explanation, and declared that the living parts of a living being were the organs formed of the tissues.

A great step was gained when Virchow thought he saw the cell in the process of being built up, that is, structured, and thus jumped to the conclusion that it is self-existent and the unit of life, from which proceed all organised forms of developed beings.

But here a difficulty arose, for the cell proved as transitory as any other anatomical element. Thus many scientists returned to the belief in primordial unstructured matter, and opinion oscillated between the

views held by 'cellularists' and 'protoplasmists', as the opposing factions came to be known. Confusion reigned among the conflicting theories as they struggled to explain how a purely chemical compound, or mixture of such compounds, could be regarded as living, and all sorts of powers of modification and transformation were ascribed to it with which we need not concern ourselves here.

Instead, let us consider the second problem that faced Béchamp and Pasteur when they started work:

How does this mysterious living substance come into being? Can it arise spontaneously, or must it always be derived from pre-existing life?

It is hard to realise nowadays the heated controversy that raged in the past around this perplexing mystery. The opposing camps of thought were mainly divided into the followers of two eighteenth-century priests; Needham, who claimed that heat was sufficient to produce animalcule from putrescible matter, and Spallanzani, who denied their appearance in hermetically sealed vessels. The first were named *Sponteparists* because of their belief that organised life is in a constant state of emergence from chemical sources, while the second were named *Panspermists* because of their theory of a general diffusion of germs of life, originally brought into being at some primeval epoch.

For the latter view the teaching of Bonnet, following upon that of Buffon, was chiefly responsible; while Buffon's ideas are reminiscent of the ancient system ascribed to Anaxagoras, according to whom the universe was formed of various elements as numerous as its different substances; e.g. gold was supposed to be formed of particles of gold; and a muscle, a bone, a heart, to be formed of particles of muscle, of bone, of heart. etc.

Buffon taught that a grain of sea salt is a cube composed of an infinite number of other cubes, and that there can be no doubt that the primary constituent parts of this salt are also cubes, which are beyond the powers of our eyes and even of our imagination.

This was an experimental fact, says Béchamp,[1] and was the basis of the system of crystallography of Hauy.

Buffon argued in the same strain that

> "in like manner that we see a cube of sea salt to be composed of other cubes, so we see that an elm is but a composite of other little elms."

1. *Les Microzymas*, p.30.

Bonnet's ideas[1] were somewhat similar; the central theme of his teaching being the universal diffusion of living germs:

> "...capable of development only when they meet with suitable matrices or bodies of the same species fitted to hold them, to cherish them and make them sprout – it is the dissemination or panspermy that, in sowing germs on all sides, makes of the air, the water, the earth and all solid bodies vast and numerous magazines in which Nature has deposited her chief riches."

He further maintained that

> "the prodigious smallness of the germs prevents them from being attacked by the causes that bring about the dissolution of the mixtures. They enter into the interior of plants and of animals, they even become component parts of them, and when these composites undergo the law of dissolution they issue from them unchanged to float in the air, or in water, or to enter into other organised bodies."

Such was the imaginative teaching with which Bonnet combated the doctrine of spontaneous generation. When it came to practical experimental proof, one party professed to demonstrate the origin of living organisms from putrescible matter in scaled vessels; the other party denied any such possibility if air were rigorously excluded; while a pastry cook named Appert put this latter belief to a very practical use, and started to preserve fruits and other edibles by this method.

And here we are led to the third conundrum:

What causes matter to undergo the change known as fermentation?

It is a puzzle that must have been brought home to many a housewife unaware of scientific problems. Why should the milk left in the larder at night have turned sour by the morning? Such changes, including the putrefaction that takes place after the death of an organism, were so much of a mystery that the causes were considered occult for a long time.

Newton had suggested that the effect was due to catalysis – a process in which a substance called a catalytic agent assists in a chemical reaction but is itself unchanged. The myriads of minute organisms revealed later on by the microscope in fermenting and putrefying matter were at first believed to be mere results of the general process of

1. See *Ire partie; Oeuvres d'Histoire Naturelle de Bonnet*; pp.83-86. Neuchatel, 1779.

putrefaction and fermentation.

A new idea was introduced by Cagniard de Latour, who suggested that fermentation is an effect accompanying the growth of the ferment. That is to say, he looked upon the ferment as something living and organised, by which fermentation is rendered a vital act. It was the microscopic study of beer yeast, undertaken about the year 1836, which brought him to the opinion that the oval cells he observed were really alive during the production of beer, decomposing sugar into carbonic acid and alcohol.

Turpin, the botanist, interpreted this as meaning that the globule of yeast decomposes sugar in the act of nourishing itself. J. B. Dumas maintained the necessity for nitrogenised albuminoid matter, as well as sugar, for food for yeast cells.

Schwann, the German, went farthest of all by declaring that all fermentation is induced by living organisms, and undertook experiments to prove these to be airborne.

But in spite of other experiments confirming Schwann's work, for a time this teaching was set aside for the view that vegetable and animal matters are able to alter *of themselves*. For instance, the theory was held that by dissolving cane sugar in water it changes of itself into grape sugar, or glucose; or, using technical terms, cane sugar undergoes inversion spontaneously.[1]

Such, roughly speaking, were the scientific ideas in circulation at the middle of the nineteenth century, when Antoine Béchamp and Louis Pasteur appeared on the scene with details of their respective experiments.

As Pasteur is renowned as the first to have made clear the phenomenon of fermentation, besides being appraised as the one who overthrew the theory of spontaneous generation, let us now, instead of taking this on trust, turn to the old French scientific documents and see for ourselves what he had to say in the year 1857.

1. The usual product of this hydrolysis, or inversion of cane sugar, is invert sugar; but, as this was formerly described as grape sugar, that expression is usually retained here.

3.
Pasteur's Memoirs of 1857

Louis Pasteur, the son of a tanner, was born at Dole in 1822. Intense strength of will, acute worldly wisdom and unflagging ambition were to be the prominent traits of his character.

He first came into notice in connection with crystallography, by discovering that the crystalline forms of the tartrates are hemihedral. His son-in-law has recorded his jubilation over his early achievement, and has told us how he left his experiment to rush out of the laboratory, fell upon the neck of a curator whom he met accidentally, and then and there dragged the astonished man into the Luxembourg garden to explain his discovery.[1]

Work so well advertised did not fail to become a topic of conversation, and the news eventually reached the ears of M. Biot. On hearing of this, Pasteur wrote to ask for an interview with this well-known scientist, with whom he had no previous acquaintance but upon whom he now showered every attention likely to be appreciated by the rather misanthropical old worker, whose influential patronage undoubtedly became the first contributing factor in the triumphal career of the ambitious young chemist.

All the same, Biot's persuasions never succeeded in gaining Pasteur a place in the Academy of Science. This he obtained only after the former's death, when nominated by the Mineralogical Section; and then, oddly enough, exception began to be taken at once to his early conclusions on crystallography.[2]

This, however, was not until the end of 1862.

Meanwhile, in 1854, Pasteur was appointed Professor and Dean of the new Faculty of Science at Lille. In 1856 a request for advice from a local manufacturer of beetroot alcohol made him turn his attention to the problem of fermentation, which was then exercising the minds of the learned. His observations were interrupted by a journey to Paris to canvass for votes for his election to the Academy of Science. Obtaining only sixteen and completely failing in his attempt to enter that select

1. *The Life of Pasteur*, René Vallery-Radot, p.39.
2. *ibid*, pp.101–2.

circle of Academicians, Pasteur returned to Lille and to his study of fermentations.

In spite of the work done by Cagniard de Latour, Schwann and others, the idea was prevalent that animal and vegetable matters are able to alter spontaneously, while the authority of the famous German chemist Liebig carried weight when he asserted that yeast induces fermentation by virtue of progressive alteration in water in contact with air.[1] Another German named Ludersdorff, so we learn from Béchamp,[2] had undertaken experiments to prove that yeast ferments sugar because it is living and organised. An account had been published in the fourth volume of the *Traite de Chimie Organique*, which appeared in 1856.

Now let us examine Pasteur's contribution towards this subject the following year, since at that date popular teaching assigns to him a thorough explanation of fermentation.

During 1857, Pasteur left Lille to work at the *Ecole Normale* in Paris; but we are not here concerned with his movements, but simply with what he had to reveal on the subject of fermentation.

His son-in-law tells us[3] that it was in August 1857, after experimenting in particular with sour milk, that Pasteur first made a submission on *Lactic Fermentation* to the Scientific Society of Lille. Be this as it may, we find his extract from a memoir on the subject in the *Comptes Rendus* of the French Academy of Science, 30th November, 1857.[4] The entire memoir was printed in April 1858 in the *Annales de Chimie et de Physique*,[5] and from this latter we gain full details.

The experiment consisted of Pasteur taking the substance developed in ordinary fermentation, nourished by sugar, chalk, casein or fibrin, and gluten (an organic matter occurring in cereals) and placing it in yeast broth (a complex solution of albuminoid and mineral matters), in which he had dissolved some sugar and added some chalk.

There was nothing new in the procedure, as Béchamp points out;[6] it was the same experiment that Liebig had undertaken some sixteen or seventeen years previously. However, unlike Liebig, he did not ignore microscopic examination, and so made observations that had been missed by the German chemist. Thus Pasteur is able to tell us that a

1. *Traite de Chimie Organique,* traduit par Ch. Gerhardt, Introduction, p.27. 1840.
2. *Les Grands Problémes Medicaux*, A. Béchamp, p.62.
3. *The Life of Pasteur*, p.83.
4. *Comptes Rendus* 45, p.913. *Memoire sur la fermentation appelee lactique*.
5. *Annales de Chimie et de Physique, 3e serie*, 52, p.404.
6. *Les Grands Problémes Medicaux*, p.56.