

CHAPTER V

CLAIMS AND CONTRADICTIONS

PROFESSOR BÉCHAMP'S great series of observations, which indeed seem to merit the name of the "Beacon Experiment," clearly demonstrated the possibility of the appearance of ferments in a medium devoid of albuminoid matter. As this fact had been disbelieved till this date, it is evident that Béchamp was the first to establish it. We may search through the old scientific records and fail to find any such demonstration by anyone. We can read for ourselves that Pasteur's procedure in 1857 was entirely different. Influenced by the prevalent belief, what he did, as we have already seen, was to take the ferment developed in an ordinary fermentation and sow it in yeast broth, a complex solution of albuminoid and mineral matters. Thus he obtained what he called his lactic fermentation. Neither does he seem to have been entirely successful in his deductions from his observations. He announced that the lactic globules "take birth spontaneously in the body of the albuminoid liquid furnished by the soluble part of the yeast," and also that "they take birth spontaneously with as much facility as beer-yeast." There can be no question of the contrast between these sponteparist views and the clear, simple explanation of Béchamp! No conscientious reader can compare the two workers' original documents without being struck by their disparity.

Where Pasteur's work was more allied to Béchamp's was in an experiment recorded among the reports of the French Academy of Science in February 1859, more than a year after the publication of Béchamp's Beacon Experiment. So certainly, from the point of date alone, it in no way repudiates Béchamp's claim to priority in clearly explaining fermentation; indeed, it seems to have been inspired by the Professor's observations, for we find that Pasteur here omitted to use yeast broth as his medium and ascribed the origin of lactic yeast to the atmospheric air.

According to his own details¹ he mixed with pure sugared water a small quantity of salt of ammonia, phosphates and precipitated carbonate of lime, and actually expressed surprise that

¹ *Comptes Rendus* 48, p. 337.

animal and vegetable matter should have appeared in such an environment. There could hardly be a greater contrast to Béchamp's rigorous deductions, while an extraordinary ambiguity follows in the conclusions. We read: "As to the origin of the lactic yeast in these experiments, it is solely due to the atmospheric air: we fall back here upon facts of spontaneous generation." After asserting that by suppressing all contact with ordinary air, or by boiling the solution, the formation of organisms and fermentation are quite prevented, he winds up: "On this point the question of spontaneous generation has made progress." If he here meant that the question had progressed toward the denial of the belief, why was it that he did not say so?

In a subsequent Memoir published in the *Annales de Chimie et de Physique*¹ in April 1860 he constantly refers to the spontaneous production of yeasts and fermentations. Anyone really aware of the atmospheric origin of micro-organisms of the nature of yeast would undoubtedly have steered clear of phraseology that, at that particular epoch, conveyed such a diametrically opposite signification.

The many experiments detailed in this latter Memoir were only commenced on 10th December, 1858, whereas Béchamp first presented his Beacon Experiment to the Academy of Science in December 1857, and its full publication appeared in September 1858, three months before Pasteur started his fresh observations. He was, undoubtedly, inspired by Béchamp in this new work for which he made claim that it illumined "with a new day the phenomena of fermentation."

Béchamp's criticism of it may be found in the Preface to his book *Le Sang*. There he explains that the formation of lactic acid, following upon the original alcoholic fermentation, was due to an invasion by atmospheric germs, in this case lactic yeast, their subsequent increase resulting in the starvation of the beer-yeast, which had been included at the start of the experiment. He maintains that Pasteur's deductions prove his lack of real comprehension of "the chemico-physiological phenomena of transformation, called fermentation, which are processes of nutrition, that is to say, of digestion, followed by absorption, assimilation, excretion, etc.," also his want of understanding of the living organism and how it would "at last reproduce itself if all conditions dependent upon nutrition are fulfilled."²

¹ *3e série*, 57-58, pp. 323 to 426 inclusive, esp. from pp. 283 to 392.

² *Le Sang*, par A. Béchamp, Preface, p. 41.

Over and above Béchamp's scientific criticism of this Memoir, any critic must be struck by the inexactitude of the detailed descriptions. For example, if we turn to the third section we find that for these observations Pasteur's medium included the ashes of yeast and that he makes mention of the addition of fresh yeast. Yet as a heading to one such experiment he gives the following misleading description: "Production of yeast in a medium formed of sugar, of a salt of ammonia and of phosphates."¹ All reference to the original inclusion of yeast, admitted on p. 383, is omitted in this heading and in his final summary: "All these results of a most rigorous exactitude, though the majority were obtained by acting upon very small quantities, establish the production of alcoholic and lactic yeast and of special fermentations corresponding to them, in a medium *formed only* of sugar, a salt of ammonia and of mineral elements."² The actual medium, detailed only a couple of pages back, consisted of:

"10 grammes of sugar.
100 cubic centimetres of water.
0.100 grm. of ammonium tartrate.
The ash from 1 gramme of beer-yeast.
Traces of *fresh yeast*, the size of a pin's head."³

Altogether it is clear that even by 1860 Pasteur had no such clear teaching to put forward as that contained in Béchamp's epoch-making observations. And here we have an illuminating view of the characters of the two men. Béchamp could not but be aware that his knowledge exceeded that of Pasteur, yet all the same, in his lectures before students, we find nothing but courteous allusions to his rivals. We need only refer to the Professor's *Lessons on Vinous Fermentation*, a work published in 1863, before his actual demonstration in explanation of the phenomenon.

In this book we learn Béchamp's views, which he was so careful always to carry into practice, on the subject of giving honour where honour is due in scientific revelations. "One can

¹ *Annales de Chimie et de Physique*, 3e série, 57-58, p. 381.

² *ibid.* 3e série, 57-58, p. 392.

³ *Annales de Chimie et de Physique*, p. 390.

"10 grammes de sucre
100 centimètres cubes d'eau
Ogr. 100 de tartrate droit d'ammoniaque
Cendres de 1 gramme de levûre
Traces de levûre fraîche (de le grosseur d'une tête d'épingle)."

only have," he says,¹ "inspired ideas or communicated ideas, and it is by working upon one and the other that new ones are conceived. That is why a seeker after truth should give the ideas of those who preceded him in his work, because those, great or small, had to make their effort, and herein lies their merit, to bring their share of truth to the world. I cannot conceive of a superior title than this of proprietary right, because it is this that constitutes our personality and often genius, if it be true that this sublime prerogative, this rare privilege, is nothing but a long patience, fecundated by the spark God has set in us. This right must be respected all the more, in that it is of the nature of the only riches, the only property, that we can lavish without impoverishing ourselves; what say I, it is in thus spending it that we enrich ourselves more and more."

Unfortunately we find a great contrast in Pasteur, who, it cannot be gainsaid, from the start, according to the old records, repeatedly arrogated to himself the discoveries of Béchamp, beginning with those of 1857.

The Beacon Experiment had flashed illumination into the darkness of sponteparist views just at a time when the controversy on spontaneous generation was destined to flame out anew. At the end of December 1858 M. Pouchet, Director of the Natural History Museum of Rouen, sent up to the Academy of Science a "Note on Vegetable and Animal Proto-Organisms Spontaneously Generated in Artificial Air and in Oxygen-Gas." The subject again gripped public interest. Professor Béchamp, seizing every spare moment for continued research, was too much occupied working to take much part in talking. Pasteur, on the contrary, kept everyone well acquainted with the experiments he purposed to undertake. There were said to be living organisms, germs, in the atmosphere, so he decided microscopically to investigate air. The method of doing so—by filtering it into glass flasks—had already been inaugurated by two Germans, Schroeder and Dusch. Experimenting in the same way, Pasteur made comparisons between the different contents of phials, which, according to him, varied with the admission of atmospheric dust and remained unaltered in examples where this was excluded. But he was not content with laboratory and cellar experiments, and planned to make observations that would be more striking and picturesque. Keeping everyone well notified

¹ *Leçons sur la Fermentation Vineuse et sur la Fabrication du Vin*, par A. Béchamp, pp. 6, 7.

of his proceedings, in September 1860 he started on a tour armed with seventy-three phials, which he opened and then summarily sealed at different places and at varying altitudes. The last twenty he reserved for the Mer de Glace, above Chamonix, with the result that in only one of the twenty were the contents found to be altered. From this time, the autumn of 1860, Pasteur, the former Sponteparist, veered round to a completely opposite standpoint, and ascribed almost all phenomena to the influence of atmospheric germs.

His immediate opponent, meanwhile, experimented on air on mountains, on plains, on the sea, and, as everybody knows, Pasteur never succeeded in convincing M. Pouchet.

Of these Pasteurian experiments Béchamp writes:¹ "From his microscopic analysis he comes to conclusions, like Pouchet, without precision (*sans rien préciser*); there are organised corpuscles in the collected dust, only he cannot say 'this is an egg, this is a spore,' but he affirms that there are a sufficient number to explain all the cases of the generation of infusoria. Pasteur thus took up the position of explaining by germs of the air all that he had explained before by spontaneous generation."

He was naturally entitled to hold any opinions that he chose, whether they were superficial or otherwise, and also to change his opinions, but we think all will agree that what he was not entitled to do was to claim for himself discoveries initiated by another worker. Yet, in a discussion on spontaneous generation, which took place at the Sorbonne during a meeting, on the 22nd November, 1861, of the *Sociétés Savantes*, Pasteur, actually in the presence of Professor Béchamp, took to himself the credit of the proof of the appearance of living organisms in a medium devoid of albuminoid matter. The Professor, with that distaste for self-advertisement which so often accompanies the highest intellectuality, listened in amazed silence until his own turn came, when, instead of putting forward the legitimate seniority of his work, he merely gave an account of the experiments described in his great Memoir and the conclusions that had resulted from them. On returning to his seat, which happened to be next to Pasteur's, he asked the latter to be so kind as to admit his knowledge of the work that had just been under description. The report of the meeting tells us of Pasteur's method of compliance.²

¹ *Les Grands Problèmes Médicaux*, par A. Béchamp, p. 13.

² *Revue des Sociétés Savantes I*, p. 81 (1862).

"M. Béchamp quoted some experiments" (those of the Memoir of 1857) "wherein the transformation of cane-sugar into grape-sugar effected under the influence of the air is always accompanied by moulds. These experiments agree with the results obtained by M. Pasteur, who hastened to acknowledge that the fact put forward by M. Béchamp is one of *the most rigid exactness*."

We cannot help thinking that Pasteur might also have added an admission that his associate had been in the field before him. A further point to be noticed is Pasteur's later contradiction of his own words, for Béchamp's work, here described by him as rigidly exact, was later to be accused by him as guilty of "an enormity."

We turn to the *Études sur la Bière*:¹ "I must repudiate a claim of priority raised by M. Béchamp. It is known that I was the first to demonstrate that living ferments can be entirely constituted from their germs deposited in pure water into which sugar, ammonia and phosphates have been introduced and protected from light and green matter. M. Béchamp, relying on the old fact that moulds arise in sugared water and, according to him, invert the sugar, pretends to have proved that organised living ferments can arise in media deprived of albuminoid matters. To be logical, M. Béchamp should say that he has proved that moulds arise in pure sugared water without nitrogen, without phosphates or other mineral elements, for *that is an enormity* that can be deduced from his work, in which there is not even the expression of the least astonishment that moulds have been able to grow in pure water with pure sugar without other mineral or organic principles."

How was it then that the present traducer of Béchamp's work should, as we have already shown, have earlier described that self-same work as possessing "rigid exactness"? Can it be that it is only when it is likely to eclipse Pasteur's that it turns into "an enormity"? And how did Pasteur come to omit all reference to the admittance of air, without which the formation of moulds would have been impossible?

At a time when Pasteur was using yeast broth and other albuminoid matters for his experiments, Béchamp, on the contrary, gave a clear demonstration that in media devoid of albuminoid matters moulds would appear which, when heated with caustic potash, set free ammonia. By the same set of experi-

¹ p. 310 (note).

ments the Professor proved that moulds, living organisms that play the part of ferments, are deposited from the air and appear in pure water to which nothing but sugar, or sugar and certain salts, have been added. Therefore by this criticism, "to be logical M. Béchamp should say that he has proved that moulds arise in pure sugared water, without nitrogen, without phosphates or other mineral elements, for that is an enormity that can be deduced from his work," M. Pasteur seems himself to have committed the enormity by thus apparently misunderstanding the facts proved by Béchamp! The latter had noted that the glass flasks filled completely with the solution of sugar and distilled water, and into which *no air* whatever was allowed to enter, moulds did *not* appear and the sugar was not inverted; but in the flasks in which *air* had remained, or into which it had been allowed to penetrate, moulds had formed, despite the absence of the albuminoid matters included in Pasteur's experiments: moreover, Béchamp had found these moulds to be more abundant when particular salts, such as nitrates, phosphates, etc., had been added.

The Professor, in his great work *Les Microzymas*,¹ cannot resist a sarcastic allusion to Pasteur's extraordinary criticism: "A chemist, *au courant* with science, ought not to be surprised that moulds are developed in sweetened water contained, in contact with air, in glass flasks. It is the astonishment of M. Pasteur that is astonishing!"

When wordy warfare ensued Pasteur was no match for Béchamp, and the former quickly saw that his own interests would be best served by passing over the latter's work as far as possible in silence. This human weakness of jealousy was no doubt one of the contributory causes of the setting aside of important discoveries which, afterwards ascribed to Büchner in 1897,² were actually made by Béchamp before 1864, in which year he first publicly employed the name *zymase* for the soluble ferment of yeasts and moulds. And it is now to these researches of his that we shall do well to turn our attention.

¹ p. 87.

² See pp. 67, 68, 84, 141.