

AN UNRECORDED EARLY LAVOISIERIANA

By Roberto A. Ferrari, roferrar@fibertel.com.ar

Introduction

Many years ago, in Buenos Aires, exploring through shelves of an antiquarian bookstore, I discovered two issues of a 1790 French monthly journal from a masonic lodge: *Tribut de la Société Nationale des Neuf Soeurs*. As soon as I found it had an article—part of a larger study—by Jean François De Machy (1728-1803), commenting on Lavoisier's *Traité Élémentaire de Chimie* (1) I bought it. It took me some years to find an almost complete set of the periodical (Bibliothèque Nationale de France) (2).

De Machy's article amounted to a 69-page commentary on Lavoisier's *Traité* in a serial of 15 installments from 1790 to 1791 (3).

Checking the main bibliographies of the history of chemistry, I realized that this very early response to Lavoisier was unrecorded by all of them: Ferguson (1906) (4); Duveen (1949) (5); Duveen and Klickstein (1954) (6); Neville (2006) (7).

Flahaut (8) quoted the journal, referring to an article by De Machy, *Réfutation des pneumatistes*, published between 1791 and 1792 but that title does not match anything published there. An earlier author (Des Essarts, 1800 (9)) mentions the article as "*Réfutation du système des pneumatistes dans les cahiers du Tribut des neuf Soeurs*." By 1794 all the installments were republished with minor variants in *L'Esprit des journaux* (pp 229-

300), also missed by all the mentioned bibliographers (10).

Jessica Riskin was aware of the journal and devoted some attention to De Machy's comments, mainly related to the new chemical nomenclature (11).

In this note I will comment on the lodge, the periodical, that article and its author, Jacques François De Machy (12).

The Lodge

During 1776 in Paris, France, a masonic lodge was founded: the *Société Nationale des Neuf Soeurs* (Nine Sisters, in reference to the muses), under the auspices of the noted astronomer Joseph Jérôme de Lalande, with the participation of Benjamin Franklin and Nicolas de Condorcet. Among its members were the balloon flight pioneer, Jean-François Pilâtre de Rozier; the naturalist Bernard de Lapepède, and the chemists Claude Louis Berthollet and Antoine-François de Fourcroy.

This lodge brought together a large part of the Parisian intellectuals. It was considered a "melting pot of the Masonic doctrines, the laboratory of pure philosophical spirit" (13). The lodge deserved a detailed study by one of the early historians of Freemasonry (14).

The Periodical

The lodge started to publish this monthly journal by January 8, 1790, each issue numbering 64 pages. The magazine has several references to the sciences, besides the articles we examine here: a translation of a text of Franklin's on meteorology; a praise of electricity, under the title of "L'Électricité—Ode;" Lalande on the definition of the standard meter based on the measurement of the earth's meridian; statistics applied to population; observations on leeches and a report of research on human vision. As far as I have been able to track this magazine, the whole collection spans from January 1790 to August 1792. The lodge and the periodical did not survive the turbulent events of August 1792.

The Author

The author was a noted pharmacist, member of several academies, having registered in the Freemasonry in 1774 as a member of the lodge *Amis Réunis* (15). By the middle of the eighteenth century, he studied with Guillaume-François Rouelle (1703-1770), as Lavoisier would do later (16).

He never adhered to the new approach of chemical ideas, rejecting the pneumatist group, defending the phlogiston theory, having translated the German authors that followed Becher and Stahl's ideas to French: Johann Juncker (17), Andreas Sigismund Marggraf (18) and Johann Heinrich Pott (19). He is mainly recorded in the history of pharmacy as an opponent of Lavoisier and the pneumatists (8, 20, 21). As a matter of fact, his extensive comments on Lavoisier's text are often ironic, showing a preconceived attitude.

Roy Neville (7) made the following comment with reference to an earlier book (22) by De Machy:

The *Instituts de Chymie* comprises his detailed course of chemistry, in which he strongly supports the doctrine of phlogiston. He never adopted the views of Lavoisier. Nevertheless, the *Instituts* is an excellent, lucidly written book, which summarizes the state of chemistry at the time of its publication.

Therefore, the critic was a renowned chemist and fully trained into the phlogiston theory.

No matter how brilliant De Machy was and how skilled he was in handling phlogiston theory, being fifteen years older than Lavoisier, a refusal of novelties may sum up his attitude against the new chemistry.

The Articles

The first of a long series, the study begins with a seven-page article by De Machy (3), entitled "Introduction a un Examen impartial de la nouvelle Doctrine des Chimistes modernes ou Pneumatistes." There is no mention of Lavoisier and the article ends with the sentence (23, 24):

To do it with method, we propose to examine successively the first seventeen chapters of a work whose clarity and method are praised: we owe it to one of the founders of the pneumatic doctrine.

Hence, this is an introduction to the subject to be developed later.

Today the term pneumatists brings to mind pneumatic chemists, followers of an experimental approach derived from the physics works of Boyle and Hales. But Demachy sees Lavoisier not as a continental representative of the English school of experimenters along the procedures elaborated by Stephen Hales; he claims Lavoisier is one of the founders of pneumatists. De Machy is attributing to the pneumatists a theoretical conception opposite to the followers of Stahl, and he was not alone in this usage at the time, but we know now that the situation was not so (25). Perrin has shown that Lavoisier was not completely opposed to Stahl's ideas, because in his 1772 speech he claims that Stahl's theory is imperfect and must be improved (26).

The next issue of *Tribut*, released in September 1790, was the first of thirteen installments, focused on commenting on the recently published work of Antoine Lavoisier under the title "Examen D'un Traité élémentaire de Chimie, présenté dans un ordre nouveau, 2 vol. In 8°." In that issue, De Machy begins the long series of notes. The first few installments are organized as a series of responses to sections of the *Traité*. Each begins with paraphrases or extracts of a chapter of the *Traité*, followed by De Machy's response or "Observations." Just after the fifth installment he introduces a six-page comment of his own authorship, entitled "Suite des observations sur la nouvelle Chymie, par M. Lavoisier" in which he repeats his opinions, already expressed in his first article against the pneumatists. The whole set of articles comprises 69 pages in all, of which over 45 correspond to De Machy's *Observations*.

When arguing, De Machy alternates between presenting contradictions within Lavoisier's system and arguing the opposite of Lavoisier's assertions. Sometimes he indulges in criticizing the style, not the idea.

As an example, we can consider one of those comments, on the first chapter, devoted by Lavoisier to base his concept of “calorique.” Lavoisier states (27, 28):

Wherefore, we have distinguished the cause of heat, or that exquisitely elastic fluid which produces it, by the term of caloric. . . . we are not obliged to suppose this to be a real substance; it being sufficient, as will more clearly appear in the sequel of this work, that it be considered as the repulsive cause, whatever that may be, which separates the particles of matter from each other; so that we are still at liberty to investigate its effects in an abstract and mathematical manner.

Even though Lavoisier strictly expressed that the caloric did not necessarily have to have a mass, De Machy argues that the caloric ought to be weighable (29, 30):

Free caloric is indemonstrable: it can never be obtained, says the author; we believe it, it does not exist. Is *combined* caloric better demonstrated? Since it is material, it must at least have some weight; because weighability is the essential attribute of matter: however light one supposes it, it still must alter the weight of a body that one would have either saturated with it or stripped of it. Since it constitutes part of the solidity of bodies, it ought to make them more solid as it abounds; but does it not contribute more than water increases the solidity of the sponge which it enters and leaves as easily as caloric is believed to be driven out or introduced?

Soon the initial success in his arguments starts to fade, when he deals with the second chapter, devoted to the formation and constitution of the atmosphere (31). De Machy denies the identity of the atmosphere and the air used in the experiments reported by Lavoisier later in the *Traité* (32, 33)

When we consider the atmosphere as only a reservoir into which go these gases of all kinds, still there must be a particular fluid which deserves to be well characterized, and which must be different from the atmosphere, as pure water differs from compound, stagnant and other waters, since these gases are possibilities, of variable heterogeneities, accidents and not usual and essential things.

He concludes his critique of the chapter by asserting (32, 34):

This second chapter therefore presents a continual confusion between air and atmosphere, petitions of possibilities that nothing proves, symmetrical arrangements of impossible layers, and this is how a laughing imagination leads you astray, you who preach to us so strong to keep us on guard against it.

When following with the third chapter of Lavoisier’s treatise, which deals with the analysis of the air, De

Machy again insists that air and atmosphere are not identical.

Lavoisier measures 27 per cent of *vital air* (oxygen) and 73 per cent of *non respirable air* (nitrogen), which for that time is a really good measurement. De Machy asks where are all the other components of air—the innumerable volatiles, etc. Unable to approach the subject quantitatively as did Lavoisier, he wrongly assumes that the other very minor products in the atmosphere need to have a notable presence in the balance.

De Machy seems to believe that oxygen and nitrogen in the air are combined as a sort of chemical compound. So he asks, for example, how it is that mercury can separate one of them from its associate. How is it that heat can both fix air into mercury and release air from it?

Guerlac highlights that De Machy—in a paper read as early as 1766 but printed 1776 (35)—was well aware of Black’s and MacBride’s experiments, denying their interpretation and rejecting that air could be part of solid compounds; he refers to a prejudice common to the most devoted of Stahl’s followers (36). So 25 years later, De Machy was strongly adhering to his own erroneous concept. Evidently, this mature man, involved deeply in the Stahl concepts wasn’t the best candidate to produce an *examen impartial*.

In the *Discours Préliminaire* to his *Traité* (1), Lavoisier clearly and strongly points to the close relationship between words and ideas, following Abbé de Condillac’s treatise (37). Then he draws our attention to the risks that the researcher runs such as subjectivity, acceptance of misconceptions, self-esteem and self-confidence; to overcome this he suggests leaving aside speculation and to concentrate on the facts, the concatenation of experiments and observations, as mathematicians perform their demonstrations, in brief steps and without losing sight of what guides them.

In short, Lavoisier proposes the reader to move forward with an open mind to observe old facts with a new look. Is that what De Machy did? It does not seem so.

Often, De Machy ironizes, as when he asks Lavoisier (38, 39):

Come, retire with good grace; you believed, not to enrich, but to embellish the chemistry, by a clicking of insignificant endings; nobody knows better than you that nitre is formed in sheds quite differently than under your bells; you know that the word oxide is a small refinement of a creator of words and that nature does better than that to form nitre and its acid. Again,

new words suit new facts; so the new nomenclature is just jargon grasped too eagerly by pupils, whose laziness it flatters, without making them either better artists or more learned chemists.

Clearly, on the subject of the new nomenclature De Machy was not alone; several personalities of the scientific world vehemently opposed the novelties (37).

Finally, his long study arrives at an end, by the December 1791 issue, titled "Suite et Conclusion de l'examen de la nouvelle Chymie, 2 vols., in 8^o" Although extensive, I consider of interest to reproduce it in full (40, 41):

TEXT [based on Ref. 1, Vol. 1, p 187]

Any building intended to defy the insults of time must be established on solid foundations.

In the state in which chemistry has arrived, its progress is delayed, if the experiments are neither sufficiently exact nor rigorous enough.

OBSERVATIONS

Reminding the reader what I developed in the preceding issues, to which I refer, I adopt conclusive axioms, and I say:

Now to the first: The natural *separation* of the molecules of a body is impossible to conceive and to reconcile with the idea of aggregation which constitutes all bodies;

The *attraction* that would press them is a contradiction with this spacing and relies on an unknown datum;

The *affinity* which, in their choice, would determine their union, is, as a cause, an inconceivable thing;

Caloric, as matter, is a chimera, since it has neither weight nor consistency.

Gases are all products of fluids expanded by current fire, which is a mode of existence of bodies, not a body.

Oxygen is an entity with two faces, acidifying one body, giving another more life; at least you have to be wary of it;

Nitrogen is mephitic only because of the putrefactive matter which forms it, or because of its enclosure in devices;

Hydrogen is another double entity, the principle of water and flammability, two contradictory qualities which make it doubtful;

Carbon and its acid are, more than any other entity, the very compound results of combustion;

Sulfur is neither a natural entity nor a simple entity;

Phosphorus is, like it, a product; both obviously composed by art;

The oxides, with the extension we allow them, beg the question;

The influence of oxygen for acid formation is impossible, if only because of the quantity which is supposed, even before oxidation;

The same influence on metallic calces is impossible, given the degree of condensation or compression that it would be necessary for this oxygen to undergo;

The formation of water is a joke; hydrogen enters it so little, and oxygen so abundantly;

The prior decomposition of an acid in order to dissolve a body is ridiculous; blunt a cutting edge to make it sharper;

The new and innumerable acids and their combinations are meticulous uselessness.

Fermentation, from all points of view, is unintelligible according to the reckoning of the new theory.

The volatile alkalis, are not composed of nitrogen and hydrogen only;

Gas experiments are not at all conclusive; you never judge after the fact; and we are mistaken when we say post hoc, ergo propter hoc;

Binary, ternary, etc. combinations of the three gases, are not the talisman of nature, but a pure jargon;

The new nomenclature is neither simpler, better founded, nor clearer, nor more precise than the old expressions.

Therefore, the Pneumatists' building is not intended to brave the insults of time, since its foundations, far from being solid, resolve into gas or the equivalent.

Now I say to the second point: geometric precision is impossible, by the very admission of the author, who often uses roughly, agrees that someone might require more rigor, uses maybe, etc. etc;

This precision is impossible in fact; the pneumatists' devices, too complicated, themselves bring incalculable obstacles to it;

All rigor, plausible on paper, is in fact subject to an infinity of exceptions;

The rigor of calculation is incompatible with the experiments, however exact they might otherwise be.

So the Pneumatists have delayed the march of chemistry by going beyond the bounds of accuracy, by affecting too much rigor, by indulging too much in Neologism.

Note. After having made the critical examination of modern chemistry, it is necessary to expose to the censorship of the Pneumatists the theory that I have made, that I have constantly taught, published and ever promoted. This matter will be the subject of a memoir for the next issue.

The promised memoir is titled “Précis Élémentaire de Chymie,” thirteen pages, published during the first three months of 1792 (42, 43). It is devoted to a speculation about molecules, the interactions among them, wondering if they touch one another in a fluid. Then, he argues that simple substances are only a few in Nature and then, moves on to deal with living beings and their food. The third article presents his classification of chemistry in three areas: *chymie physique*, *chimie analisante* and *chimie appliquée aux arts*, ending with a call to Pneumatists, apparently never answered: “As for the Pneumatists, I put it to them to fight their own method in turn if they find errors there” (44, 45).

The turbulent Parisian events of 1792 explain by themselves the disappearance of this publication and therefore any chances to continue this discussion.

Conclusions

De Machy’s argumentation alternates between a rational critique and a preconceived attack on an opponent from the adversary’s trench. He does not enter the game proposed by Lavoisier of a new language and new approaches; each suggestion is encountered by its antithesis.

With reference to the last axioms at the end of his long analysis “Suite et Conclusion” (40) we confirm that he still thinks qualitatively, unable to grasp the pneumatists’ approach, even rejecting to consider a new language for chemistry. His concept of chemical combination is more a physical one as he cannot accept how so much volume of gas (oxygen) can be lodged in so small a volume of solid calces.

Why does De Machy resort to the masonic publication, probably with a small circulation and not specialized in science? Such a respected author could have accessed either of the two main periodicals of those days: the *Annales de Chimie* (1789-1815 with interruption between 1794-96) and the *Observations sur la physique*. The latter was under the control of Jean-Claude de La Métherie (1743-1817), opponent of new ideas. Although the publishers of the *Annales* announced that they would admit memoirs of opposing theories, it was clearly a journal related to the new chemistry (46).

The absence of recognition in all chemical bibliographies and contemporary studies suggests that the influence of this long presentation must be slight or none. Even the lack of any polemics in the *Tribut* or other journals seems to point to a small distribution of this periodical. Several reasons were converging: immediately after

his memoirs from 1783, Lavoisier began to gain approval for his theories from Claude-Louis Berthollet, Louis-Bernard Guyton de Morveau and Antoine Fourcroy, who defended them (47) as well among French scientists of different branches (37), as if a barrier between physics and chemistry had fallen apart; the pneumatic approach with its clearer explanations and the new nomenclature won the attention of most of the community.

The incorporation of a new nomenclature, the reclassification of certain substances from simple to complex and vice versa, the replacement of the phlogiston principle by that of oxygen, the quantification in operations, the introduction of instruments of physics, were too many demands for the more conservative of a generation of chemists; for others, the new theory offered luminous horizons: the analysis of water, the explanation of combustion, the analysis of air, the possibility of measuring the products in a gaseous reaction, the continuation and improvement of the Stahlian idea of the composition of substances—the *partie intégrante*—in short, the arrival of an overcoming theory (16, 48, 49, Rappaport, 1961; Siegfried & Dobbs, 1968; Gough, 1988).

This comment by Joseph Black in a letter to Lavoisier was prophetic (50, 51):

I am convinced that your doctrine is infinitely better founded than the former and in this respect they cannot suffer from comparisons, but if the power of habit prevents some of the old chemists from approving your ideas, young people will not be influenced by the same power; they will line up universally on your side.

Acknowledgment

I am deeply indebted to Dr. Carmen Giunta, who read and criticized a draft of this article, making useful suggestions and calling my attention to some typos. He also kindly called my attention to Ref. 10.

Appendix

This is a list of De Machy’s articles in the *Tribut de la Société Nationale des Neuf Soeurs*

August 1790: “Introduction a un Examen impartial de la nouvelle Doctrine des Chimistes modernes ou Pneumatistes,” pp 116-123.

September 1790: “Examen D’un Traité élémentaire de Chimie, présenté dans un ordre nouveau, 2 vol. In 8°,” pp 179-188.

October 1790: “Suite de L’ Examen impartial de la Doctrine des Chimistes Pneumatistes. Chapitre II de l’Ouvrage

de M. Lavoisier. Vues générales sur la formation des atmosphères,” pp 256-260.

November 1790: “Suite de L’ Examen impartial du Traité élémentaire de Chimie, présenté dans un ordre nouveau. Chapitre IV [*sic*]. Analyse de l’Air, de l’Atmosphère, etc etc,” pp 305-310.

December 1790: “Suite de L’ Examen impartial d’un ouvrage intitulé Traité élémentaire de Chimie, présenté dans un ordre nouveau. Chapitre V [*sic*] De la composition du gaz oxigène du soufre et phosphore, etc. Formation des acides en général,” pp 390-392.

January 1791: “Suite de L’ Examen impartial du Traité élémentaire de Chimie, présenté dans un ordre nouveau. Chapitre V Nomenclature des différentes parties constituant l’air de l’atmosphère ,” pp 69-71.

February 1791: “Suite des observations sur la nouvelle Chymie, par M. Lavoisier,” pp 107-112. [All text by Demachy]

March 1791: “Suite de l’examen de la nouvelle Chymie, Deux Volumes in 8°, Chapitre VIe. Nomenclature général des acides, et spécialement de ceux tirés du nitre et de sal marine,” pp 187-191.

April 1791: “Suite de l’examen de la nouvelle Chymie, Deux Vols. in 8°, Chapitre VIIe Décomposition du gaz oxigène par les métaux et formation des oxides métalliques,” pp 263-266.

May 1791: “Suite de l’examen de la Chymie moderne, Deux Vols. in 8°, Chapitre 10 De la combinaison des substances combustibles les unes avec les autres,” pp 46-50.

June 1791: “Suite de l’examen de la nouvelle Chymie, Deux Vols. in 8°, Chapitre 11 Considérations sur les oxides et acides à plusieurs bases, et sur la composition des végétaux et des animaux,” pp 93-97.

July 1791: “Suite de l’examen de la nouvelle Chymie, Deux Vols. in 8°, Chapitre 12 De la décomposition par le feu, des matières végétales,” pp 197-201.

October 1791: “Suite de l’examen de la nouvelle Chymie, Deux Vols. in 8°, Chapitres 13, 14 et 15 De la décomposition des oxides par la fermentation vineuse, et des fermentations putride et acéteuse,” pp 347 [*sic*]-254.

November 1791: “Suite de l’examen de la nouvelle Chymie, Deux Vols. in 8°, Chapitres 16 et 17 Formation de sels neutres, etc. et suite,” pp 326-329.

December 1791: “Suite et Conclusion de l’examen de la nouvelle Chymie, 2 vols., in 8°,” pp 393-397.

January 1792: “Précis Élémentaire de Chymie,” pp 39-43.

February 1792: “Suite du Précis Élémentaire de Chymie,” pp 98-101. [I have been unable to get this one; it is missing from the only digitized collection I know.]

March 1792: “Conclusion du Précis Élémentaire de Chymie,” pp 192-195.

References and Notes

1. A.-L. Lavoisier, *Traité élémentaire de chimie*, Cuchet, Paris, 1789, 2 vol.
2. A funny situation happened at the New York Public Library, which has several issues, partially unopened. Readers are allowed to look at the journal but not to cut the unopened pages due to a preservation policy.
3. J. F. De Machy, “Introduction a un Examen impartial de la nouvelle Doctrine des Chimistes modernes ou Pneumatistes,” *Tribut de la Société Nationale des Neuf Soeurs*, **1790 (Aug.)**, 116-123 and subsequent installments. The installments of this series are listed in detail in the Appendix. An installment appeared in nearly every monthly issue from August 1790 through December 1791.
4. J. Ferguson, *Bibliotheca Chemica*, Glasgow, 1906, volume I.
5. D. Duveen, *Bibliotheca Alchemica et Chemica*, H & S, Utrecht, 1986.
6. D. Duveen and H. Klickstein, *A Bibliography of the Works of Antoine Laurent Lavoisier 1743-1794*, Dawson & Sons, London, 1954, and D. Duveen and H. Klickstein, *Supplement to A Bibliography of the Works of Antoine Laurent Lavoisier 1743-1794*, Dawson & Sons, London, 1965.
7. R. Neville, *The Roy G. Neville Historical Chemical Library*, Chemical Heritage Foundation, Philadelphia, 2006.
8. J. Flahaut, “Lavoisier et les pharmaciens parisiens de son temps,” *Revue d’Histoire de la Pharmacie*, **1995**, 307, 349-360.
9. N. T. L. Des Essarts, *Les siècles littéraires de la France ou Nouveau dictionnaire historique, ...* Paris, chez l’Auteur, an VIII (1800), vol. II, p 288.
10. De Machi, “Examen impartial de la nouvelle doctrine des chymistes modernes ou pneumatistes,” *L’Esprit des journaux*, **1794(1)**, 229-300; available online at <https://books.google.com/books?id=p6ZBAAAACAAJ&pg=PA229> (accessed Oct. 8, 2020).
11. J. Riskin, *Science in the Age of Sensibility*, Univ. of Chicago Press, Chicago, 2002.
12. Alternatively, his name is spelled Demachy, De Machy, even De Machi. I decided to quote it the way he signed the articles.
13. B. Fay, *Franklin*, Anaconda, Buenos Aires, 1961.
14. L. Amiable, *Une loge maçonnique d’avant 1789, la Loge des Neufs Soeurs*, Alcan, Paris, 1897.
15. G. Bord, *La Franc-Maçonnerie en France—Des origines a 1815*, Nouvelle Librairie Nationale, Paris, ca. 1909, 2 vols.
16. R. Rappaport, “Rouelle and Stahl: The Phlogistic Revolution at France,” *Chymia*, **1961**, 7, 73-102.

17. J. Juncker, *Éléments de chymie, suivant les principes de Becker et de Stahl*, Hardy, Paris, 1757, 6 vols.
18. A. S. Marggraf, *Opuscules chimiques*, chez Vincent, Paris, 1762, 2 vols.
19. J. H. Pott, *Dissertations chimiques...*, Herissant, Paris, 1759, 2 vols.
20. D. Todericiu, "Jacques-François Demachy, académicien manqué et technologue méconnu du XVII^e siècle," *Physis*, **1977-1979**, 19, 355-375.
21. L.-G. Toraude, *Étude historique, anecdotique et critique sur J.-F. Demachy et ses oeuvres*. Poitiers, 1906.
22. J. F. De Machy, *Instituts de Chymie...*, Paris, 1766.
23. All the French to English translations are by the author. I decided to keep the original text unaltered, retaining some antique French spellings. Of course, any mistake is mine. For example, De Machy alternatively writes oxygène or oxigène.
24. Pour le faire avec méthode, nous nous proposons d'examiner successivement les dix-sept premiers chapitres d'un ouvrage dont on vante la clarté et la méthode: on le doit à un des fondateurs de la doctrine pneumatique.
25. L. M. Principe, "A Revolution Nobody Noticed? Changes in Eighteenth-Century Chemistry," in L. M. Principe, Ed., *New Narratives in Eighteenth-Century Chemistry*, Springer, Dordrecht, Netherlands, 2007.
26. C. Perrin, *Research Traditions, Lavoisier and the Chemical Revolution*, *Osiris* (2nd series), **1988**, 4, 53-81.
27. A.-L. Lavoisier, *Elements of Chemistry*, translation of Ref. 1 by R. Kerr, William Creech, Edinburgh, 1790, pp 5-6.
28. Nous avons en conséquence désigné la cause de la chaleur, le fluide éminemment élastique qui la produit, par le nom de *calorique*. ...Nous ne sommes pas même obligés de supposer que le calorique soit une matière réelle: il suffit, comme on le sentira mieux par la lecture de ce qui va suivre, que ce soit une cause répulsive quelconque qui écarte les molécules de matière et on peut aussi en envisager les effets d'une manière abstraite et mathématique.
29. J. F. De Machy, "Examen D'un Traité élémentaire de Chimie, présenté dans un ordre nouveau, 2 vol. In 8^o," *Tribut de la Société Nationale des Neuf Soeurs*, **1790 (Sept.)**, 179-188.
30. La [*sic*] Calorique *libre* est indémontrable: on ne peut jamais l'obtenir, dit l'auteur; on le croit bien, il n'existe pas. Le Calorique *combiné* est-il mieux démontré? Puisque c'est une matière, il doit au moins avoir une pondérance quelconque; car la pondérabilité est l'attribut essentiel de la matière: quelque léger qu'on le suppose, encore doit-il faire varier le poids d'un corps qu'on en auroit ou saturé ou dépouillé; il devroit puisqu'il constitue une partie de la solidité des corps, les rendre plus solides à mesure qu'il abonde; mais il n'y contribue pas plus que l'eau n'augmente la solidité de l'éponge dans laquelle elle entre et sort aussi facilement qu'on croit chasser ou introduire le Calorique?
31. Chapter II of the *Traité* is titled "Vues générales sur la formation & la constitution de l'atmosphère de la terre" and De Machy titles that section as: "Vues générales sur la formation des atmospheres." Is it an error, a simplification, or a manipulation? I cannot specify it.
32. J. F. De Machy, "Suite de L' Examen impartial de la Doctrine des Chimistes Pneumatistes. Chapitre II de l'Ouvrage de M. Lavoisier. Vues générales sur la formation des atmospheres," *Tribut de la Société Nationale des Neuf Soeurs*, **1790 (Oct.)**, 256-260.
33. Quand nous considérerions l'atmosphère que comme un réservoir dans lequel se rendent ces gaz de tout genre, encore doit-il y avoir un fluide particulier qui mérite bien d'être caractérisé, et qui doit-être différent de l'atmosphère, comme l'eau pure differe des eaux composées, stagnantes et autres, puisque ces gaz sont des possibilités, des hétérogénéités variables, des accidens et non des choses habituelles et essentielles.
34. Ce second chapitre présente donc une confusion continue entre l'air et l'atmosphère, des pétitions des possibilités que rien ne prouve, des arrangements symétriques de couches impossibles, et c'est ainsi qu'une imagination riante vous égare, vous qui nous prêchez si fort de nous tenir en garde contre elle.
35. J. F. De Machy, "Recherches sur quelques propriétés accordées à l'air," *Observations sur la Physique*, **1776**, 7, 301-304.
36. H. Guerlac, *Lavoisier: The Crucial Year*, Cornell University Press, 1961.
37. M. Beretta *The Enlightenment of Matter*, Science History Publications, 1993.
38. J. F. De Machy, "Suite de l'examen de la nouvelle Chymie, Deux Volumes in 8^o, Chapitre VIe. Nomenclature général des acides, et spécialement de ceux tirés du nitre et de sel marine," *Tribut de la Société Nationale des Neuf Soeurs*, **1791 (March)**, 187-191.
39. Allons, expédiez-vous de bonne grace; vous avez cru, non enrichir, mais embellir la chymie, par un cliquetis de terminaisons insignifiantes; personne ne sait mieux que vous que le nitre se forme dans les angards tout autrement que sous vos cloches; vous savez que le mot oxide est un petit raffinement de créateur de mots et que la nature s'y prend mieux que cela pour former le nitre et son acide. Encore un coup, des mots nouveaux conviennent à des faits nouveaux; donc la nouvelle nomenclature n'est qu'un jargon saisi trop avidement par les élèves, dont elle flatte la paresse, sans les rendre ni meilleurs artistes ni plus savants chymistes.

40. J. F. De Machy, "Suite et Conclusion de l'examen de la nouvelle Chymie, 2 vols., in 8°," *Tribut de la Société Nationale des Neuf Soeurs*, **1791 (Dec.)**, 393-397.

41. **TEXTE** [from Lavoisier (Ref. 1, Vol. 1, p 187)]

Tout édifice destiné à braver les outrages du tems doit être établi sur des fondemens solides.

Dans l'état où est parvenu la chymie, on en retarde la marche, si les expériences ne sont, ni assez exactes, ni assez rigoureuses.

OBSERVATIONS

En faisant souvenir le lecteur que ce qui suit est développé dans les cahiers précédens, auxquels je renvoie, j'adopte des axiomes aussi concluans, et je dis:

1° Or, l'écartement naturel des molécules d'un corps est impossible à concevoir et à concilier avec l'idée d'agrégation qui constitue tout corps;

L'attraction qui les pousseroit est une contradiction avec cet écartement et pose sur une donnée inconnue;

L'affinité qui, dans leur choix, détermineroit leur union, est, comme cause, une chose inconcevable;

Le calorique, comme matière, est une chimère, puisqu'il n'a ni pesanteur ni consistance;

Les gaz sont tous des produits de fluides mis en expansion par le feu actuel, qui est une manière d'être des corps, et non un corps;

L'oxygène, est un être à deux visages, acidifiant un corps, donnant à un autre plus de vie; il faut au moins s'en défier;

L'azot, n'est méphitique qu'à cause des matières putréfiantes qui le forment, ou de sa circonscription dans des appareils;

L'hydrogène, est un autre être double, principe de l'eau et de l'inflammabilité, deux qualités contradictoires qui le rendent douteux;

Le carbone et son acide sont, plus que tout autre corps, les résultats très-composés de la combustion;

Le soufre n'est ni un corps naturel, ni un être simple;

Le phosphore est, ainsi que lui, un produit; tous deux évidemment composés par l'art;

Les oxydes, avec l'extension qu'on se permet à leur égard, sont une pétition de fait;

L'influence de l'oxygène pour la formation des acides est impossible, ne fût qu'à cause de la quantité qu'on ne suppose, même avant l'oxydation;

La même influence sur les chaux métalliques est impossible, attendu le degré de condensation ou de compression qu'il faudroit qu'éprouvât cet oxygène;

La formation de l'eau est une dérision; l'hydrogène y entre pour si peu, et l'oxygène si abondamment;

La décomposition préalable d'un acide pour qu'il dissolve un corps, est ridicule; é mousser un tranchant pour le rendre plus coupant;

Les nouveaux et innombrables acides et leurs combinaisons, sont des inutilités minutieuses.

La fermentation, sous tous ses points de vue, est inintelligible d'après les calculs de la nouvelle théorie.

Les alkalis volatils, ne sont pas composés d'azot et d'hydrogène seulement;

Les expériences gazeuses ne sont rien moins que concluantes; on ne juge jamais a posteriori; et on se trompe lorsqu'on dit *post hoc, ergo propter hoc*;

Les combinaisons binaires, ternaires, etc. des trois gaz, ne sont pas le talisman de la nature, mais un pur jargon;

La nomenclature nouvelle n'est ni plus simple, ni mieux fondée, ni plus claire, ni plus précise que les anciennes expressions.

Donc, l'édifice des Pneumatistes n'est point destiné à braver les outrages du tems, puisque ses fondemens, loin d'être solides, se résolvent en gaz ou l'équivalent.

Je dis: 2°. Or, *La précision géométrique* est impossible, de l'aveu même de l'auteur, qui souvent a recours aux *a-peu-près*, convient qu'un pourroit exiger plus de *rigorisme*, se sert de *peut-être*, etc. etc;

Cette précision est impossible dans le fait; les appareils des Pneumatistes, trop compliqués, y apportent même des obstacles incalculables;

Tout rigorisme, soutenable sur le papier, est dans le fait sujet à une infinité d'exceptions;

Le rigorisme du calcul est incompatible avec les expériences, quelqu'exactes soient-elles d'ailleurs.

Donc les Pneumatistes ont retardé la marche de la chymie en excédant les bornes de l'exactitude, en affectant trop de rigorisme en se livrant trop au Néologisme.

Nota. Après avoir fait l'examen critique de la chymie moderne, il est de toute justice d'exposer à la censure des Pneumatistes la théorie que je me suis faite, que j'ai constamment enseignée, publiée et jamais pronée. Cet exposé sera la matière d'un mémoire pour le prochain cahier.

42. J. F. De Machy, "Précis Élémentaire de Chymie," *Tribut de la Société Nationale des Neuf Soeurs*, **1792 (Jan.)**, 39-43 and subsequent installments. The last three entries in the appendix comprise this article.

43. *L'Esprit des journaux* also published the whole of the *Précis* in one issue—a month before the *Examen* in fact: De Machy, "Précis Élémentaire de Chymie," *L'Esprit des journaux*, **1793(12)**, 244-253; available online at <https://books.google.com/books?id=tvFOPddC-EcC&pg=PA244> (accessed Oct. 8, 2020).

44. J. F. De Machy, "Conclusion du Précis Élémentaire de Chymie," *Tribut de la Société Nationale des Neuf Soeurs*, **1792 (March)**, 192-195.
45. Quant aux pneumatistes, je les mets à même de combattre, à leur tour, leur méthode, s'ils y trouvent des erreurs.
46. M. Crosland, "Lavoisier and the 'Annales de Chimie:' a Medium for the Propagation of the New Chemistry Beyond the Eighteenth Century," in *Lavoisier i els orígens de la química moderna, 200 anys després (1794-1994)*, Societat Catalana d'Història de la Ciència i de la Tècnica, Barcelona, 1996.
47. A. Mieli, *Lavoisier y la formación de la teoría química moderna*, Austral, Buenos Aires, 1944.
48. R. Siegfried and B. J. Dobbs, "Composition, a Neglected Aspect of the Chemical Revolution," *Annals of Science*, **1968**, 24, 275-293.
49. J. B. Gough, "Lavoisier and the Fulfillment of the Stahlia Revolution," *Osiris*, **1988**, 4, 15-33.
50. J. Black, "Copie d'une lettre de M. Joseph Black, a M. Lavoisier," *Annales de chimie*, **1791**, 8, 225-229.
51. Je suis convaincu que votre doctrine est infiniment mieux fondée que l'ancienne & sous ce rapport, elles ne peuvent souffrir de comparaisons, mais si le pouvoir de l'habitude empêche quelques-uns des anciens chimistes d'approuver vos idées, les jeunes ne seront pas influencés par le même pouvoir; ils se rangeront universellement dans votre côté.

About the Author

Roberto Ferrari is an independent researcher based in Argentina who splits his time between instrumental chemical analysis and the history of science, publishing in local journals (*Saber y Tiempo*) and conference proceedings. Among his books are *Radiactiva Buenos Aires*, Buenos Aires, 2020; *Publicaciones Argentinas con Fotografías Originales*, Buenos Aires, 2019; *Redescubrimiento de la copia americana del contrato Niépce-Daguerre*, Buenos Aires, Editorial Facultad de Agronomía, 2010 (coauthored with Diego Medan); *Antología (1835-1910) - Germán Avé-Lallemant*, Buenos Aires, Ediciones Biblioteca Nacional, 2008 (coeditor with V. García Costa).

HSS and SHOT to Meet in New Orleans

The annual meetings of the History of Science Society (HSS) and the Society for the History of Technology (SHOT) are scheduled jointly for November 18-21, 2021, in New Orleans, Louisiana, USA. The History of Science Society Forum for the History of Chemical Sciences (FoHCS) will hold sessions on the theme of Chemical Humanities and History of Chemistry.

Further information about the meeting can be found at hssonline.org/meetings/2021-hss-annual-meeting/ and www.historyoftechnology.org.