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978-0-521-56672-8 - Antoine Lavoisier: Science, Administration and Revolution

Arthur Donovan

Excerpt

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Introduction

In the second half of the eighteenth century Antoine Lavoisier (1743–94) developed a novel set of theories that transformed the science of chemistry. Thanks to this achievement he has, along with Copernicus, Galileo, Newton, Darwin, and Einstein, long been recognized as a leader of one of the classic scientific revolutions in modern history. His contributions to the chemical revolution of the eighteenth century, that century's only canonical scientific revolution, have earned him the title of the founder of modern chemistry and a place in the pantheon of scientific immortals.

Lavoisier was guillotined during the Terror in 1794 and hence is also remembered as one of the French Revolution's most famous victims. What his execution tells us about the connections between scientific and political progress is still a matter of considerable debate. When thinking about the relationship between his science and his political fate, it is important to remember that, in addition to being a great scientist and a political victim, Lavoisier was a prominent administrator during the final decades of the old regime. He was deeply involved in governmental affairs as a tax official and financier, as a director of the Gunpowder Administration, as a spokesman for the Academy of Sciences, and as a loyal citizen who at the outset optimistically welcomed the political revolution that in the end took his life.

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This then is the story of a great scientist who played a leading role in a number of public forums in Paris, the cultural capital of Europe, during a period of extraordinary intellectual and political ferment. The account that follows unfolds chronologically and ranges widely. The narrative is organized around several themes that were of fundamental importance to Lavoisier throughout his life. Once these themes have been identified, it becomes evident that many of his achievements as a scientist were informed by beliefs that shaped other aspects of his career as well. While my goal has been to provide an integrated account of his life, I have anchored this account in specifics by describing particular historical events, by reading selected texts closely, and by tracing out certain cognitive and institutional continuities. If this book succeeds, it will render the public career of this complex individual more intelligible, his scientific achievement more accessible, and the meaning of his life and death more comprehensible.

Readers more impressed by the costs of science than its benefits and those who are still cheered by the overthrow of the old regime may find this account of Lavoisier insufficiently censorious. Biographers are often seduced by their subjects, and the arts and consequences of seduction can be undeniably charming. I freely confess that after years of living with Lavoisier I have grown to admire him, yet in writing this account of his life I have not sought to bathe him in a theatrical aura of goodness and grandeur. I set out to examine his life and career evenhandedly and in the end I found nothing to condemn in his conduct as an individual. Not being inclined to pass judgment on entire epochs or classes, I have told the story of his life as I found it. Lavoisier was most certainly privileged and no doubt he was frequently haughty and impatient, but the biographer's emotional responses to his subject's social position and manners are not matters of great importance. When weighed in the scales of his own age or as a figure in the history of science, Lavoisier commands respect and admiration. If those who think otherwise know of evidence that justifies a more critical appraisal of him, I look forward to seeing it.

This book is not a case study written to support a particular theory of scientific change, nor does it attempt to provide either an exhaustive account of Lavoisier's life or a comprehensive assessment of his contributions to the development of modern chemistry. It is, quite simply, an

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historical biography written for those who know of Lavoisier as a scientist and wish to get a better sense of the man and his times, and for those who know of Lavoisier as a prominent figure in the French Enlightenment and wish to know more about his science. Perhaps a study that emphasizes how a great scientist at the beginning of the modern age constructed and managed a wide-ranging and influential public career can throw some light on our understanding of the cultural role of science two centuries after his death. There is, after all, nothing wrong with looking to history for lessons that can be applied to the present.

Lavoisier was frequently involved in controversies and any account of his life must therefore grapple with such contentious topics as the status and uses of science in the Enlightenment, the treatment of scientists during the political Revolution, and the social circumstances that encouraged the rise of modern science. My intention throughout has been to build upon the best-informed and most illuminating scholarly treatments of these issues. Recent studies of the Enlightenment and the French Revolution have demonstrated there is still much to be learned about the era and culture in which Lavoisier made his career; the history of modern science is being revised in an equally dramatic manner. If our accounts of Lavoisier, of eighteenth-century science, and of the interaction of science and politics are to remain current, they must incorporate the spirit and substance of these recent historiographic advances.

The narrative that follows unavoidably makes use of a number of familiar but potentially misleading concepts. It would be tiresome to fuss over each of them individually, but a general caution on the dangers of anachronism is in order. Terms such as science, experiment, chemistry, culture, politics, and revolution are all in active use today and carry connotations that most readers routinely treat as unproblematic. The same is true of such technical terms as elements, atoms, and molecules, all of which were employed in eighteenth-century scientific discourse. I have used these terms as convenient bridges between the present and the past. It should not be assumed, however, that the reader's late twentieth-century understanding of chemistry, revolution, or molecule accurately represents the meanings attributed to these terms in the eighteenth century. Reading, happily, imposes

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interpretive demands on the reader. I have done my best to make the style and argument of this book transparent, yet the reader should remember that in the final analysis the meaning of certain terms and the implications of certain events may not be exactly what they seem on first encounter.

The vocabulary of politics raises the most daunting problems in this regard. The French Revolution was an event of such epochal importance in modern political history that an act of considerable imagination is required to see behind it. We must pierce this veil if we wish to understand how Lavoisier's science arose from and fitted into the culture of pre-revolutionary France. To acquire some sense of the world Lavoisier inhabited, one must try to conceive of politics and culture as he encountered them as a young man. Only then can one appreciate the ways in which he orchestrated the interests, ideas, and institutions at his disposal while constructing his career as a scientist and administrator.

French politics in the eighteenth century can be seen as a public drama with a plot governed by three competing conceptions of political legitimacy.¹ The first of these political visions, described in more detail in parts I and II below, emphasized enlightened absolutism and administrative centralization. By the 1760s, when Lavoisier entered public life, this Bourbon strategy of governance had been pursued for over a century and had brought great power and glory to the French nation.

Proponents of political absolutism considered the king the sole representative of the nation; this was the fundamental sense in which his power was thought to be absolute. Absolutism was a strategy designed to banish forever the kind of factional politics that had reduced French public life to a shambles in the middle of the seventeenth century. The aura of absolutism made it appear that this public life had been thoroughly depoliticized. In fact, however, the king's power was severely limited and he was obliged by the realities of finance, communication, and administration to treat with deference the rights and privileges of France's various social orders and corporations. While the Bourbon kings did not openly tolerate political opposition of any sort, in practice they treated as legitimate a respectful defense of traditional liberties. This unavoidable acknowledgement of diversity and particularism

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prevented the monarchy from becoming totalitarian in practice. It also created a space within which lively-minded public figures like Lavoisier could pursue courses of action that combined ideas drawn from both the doctrines of monarchic absolutism and those of republican liberalism.

The 1770s and 1780s, the decades considered in part II, were years of intense contestation in French political life. As the monarch's ministers pressed for further centralization, the defenders of traditional rights and privileges were driven to increasingly extreme forms of reaction. They defended with vigor what they termed their ancient liberties and articulated a distinctive political ideology to support their positions. Spokesmen for the nobility of both the robe and the sword and for the church hierarchy were most assuredly not democrats, but neither were they self-serving aristocrats of the sort the Jacobins condemned when seeking to justify revolutionary seizures of power and property. Most aristocrats opposed the growing power of the centralizing monarchy rather than the idea of monarchy itself, and they were acting on principle as much as in their own behalf when they openly challenged the king and his ministers in a variety of forums. Their views were most strenuously asserted by the *parlements*, the nation's sovereign law courts. Lavoisier, who was himself a member of the Order of Barristers of the Parlement of Paris, was thoroughly familiar with the concerns and claims of this aristocratic opposition. In the end the aristocratic reactionaries made it impossible for the king to govern. By bringing the government to its knees, those opposed to further centralization prepared the way for new forms of governance that struck root during the Revolution.

A third, more radical vision of politics was also being articulated in Paris during the 1770s and 1780s. Its partisans accepted in principle the claim that France is a single nation. They challenged, however, the claim that the king is the sole legitimate representative of all Frenchmen. Rousseau's concept of a people bound together by a "general will" was crucial in this regard, as was his motivating moral dismay over the evils of luxury and the corruption of the aristocracy and the court. Populists and proto-democrats insisted that the nation consists of its people and that they alone have the right to select their representatives. This strain of political thought flourished luxuriantly once the

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reactionary politics of caste and privilege had brought royal government to a standstill. The ascendancy of this conception of nation and state during the revolution had profound political consequences, some of which are examined in part III.

The monarchic drive toward administrative centralization, and the reactionary and populist responses it occasioned, defined the political context of Lavoisier's life up to the beginning of the Revolution. There was considerable room for maneuver in pre-revolutionary politics and Lavoisier made full use of it when deploying the resources available to him within the Academy of Sciences and in his other administrative activities. When the collapse of royal government broke the mold of political life as he had known it, however, Lavoisier, like all his contemporaries, had to concentrate on staying afloat while being swept along by events. He remained relatively optimistic in the mounting storm and right up to the end continued to be as active in public life as circumstances permitted. His was a life filled with intense and sustained public engagements on many fronts. Its story reveals a great deal about the man, the age in which he lived, and a number of attempts to integrate scientific, cultural, and political developments during an historical epoch of exceptional interest and consequence.

Many scholars have examined Lavoisier's role in the chemical revolution. The following chapters on his science contain much that will be familiar to specialists, yet they also go beyond existing accounts by emphasizing certain themes that infused his scientific achievements with coherence and meaning. The interpretation offered begins with the observation that Lavoisier saw himself as applying the method of experiment, especially as utilized by experimental physicists, to certain unresolved theoretical problems in chemistry. His commitment to the precise use of instruments, to analytic rigor, and to experimental verification of theories constituted a self-conscious, although not original, scientific style. Lavoisier certainly was not the first or only chemist of his time to privilege the techniques of experiment. Rather, like many of his contemporaries, Lavoisier saw the methods of experimental physics as an especially powerful resource that enlightened and public-spirited *philosophes* could deploy with advantage when engaging problems in both science and public administration. At one point, for instance, Lavoisier suggested that enumerating the population of France pro-

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vided a “thermometer of public prosperity.” And he would have applauded, I believe, the author who declared that “experiment, research, calculation are the probe of the sciences. What problems could not be so treated in administration!”²

Although thoroughly committed to the instrumental, analytic, and theoretical methods of experimental physics, Lavoisier realized that the science of chemistry could not be transformed simply by making more rigorous use of a well-known methodology. Lavoisier’s scientific achievement belongs to chemistry rather than physics because he succeeded in marrying his rhetoric of numbers and his methodology of experiment to significant chemical problems.³ His mastery of chemistry emerged from a prolonged and strenuous engagement with the investigative traditions and distinctive concepts of chemistry itself. To understand the origins and meaning of that achievement, therefore, one must examine both the style and substance of the research program he pursued.

Early in his career Lavoisier fixed his attention on certain chemical concepts and problems he encountered while studying with the chemist L. C. de La Planche and while attending the lectures of G. F. Rouelle. The research program he constructed to investigate these problems, and the discoveries and theories for which he is remembered, are described below in chapters 3, 4, 6, and 7. Lavoisier’s new theories were of central importance to the chemical revolution of the eighteenth century, but the account of his science presented in this biography should not be read as a history of the revolution itself. The chemical revolution was the work of many hands and his allies and opponents reacted to his innovations in ways that are far too complex to chronicle here. Therefore, while this biography will, I hope, help clarify our understanding of the chemical revolution, it does not pretend to provide a comprehensive reinterpretation of that larger event.

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Part I

*Ambition,
Knowledge, and
Public Service:
1743 to 1775*

1

*The Barristers of
Paris*

Lavoisier celebrated his twenty-first birthday on 26 August 1764. He was spending that summer, as he had spent the preceding years, living quietly and comfortably in Paris with his father, his maternal grandmother, and his aunt. He had just finished several years as a student of both law and science. He completed his legal studies at the beginning of the summer and was looking forward to committing himself to a career. It appears that Lavoisier, who was not given to indecision, already considered himself destined for science. He had made certain scientific observations while a student, but it was not until the summer of 1764 that he undertook a research program specifically designed to earn him a prominent place in the world of French science.¹

Lavoisier studied law to satisfy his family's expectations. The law was a safe, respectable profession, and had his fascination with science turned out to be nothing more than a youthful enthusiasm, he could have returned to the law at a later date. Lavoisier knew that having access to an honorable calling was a matter of considerable importance to young men in the hierarchical society of eighteenth-century France. His family had done well through its association with the courts in Paris and he had good reason to secure his claim to this part of his

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inheritance before venturing forth into the less secure world of science.

Lavoisier qualified for the law by completing the required three years as a student in the Paris law faculty; he was awarded a bachelor's degree after the first two years and a *licence* following the third. With these certificates in hand he presented himself as a candidate for admission to the Order of Barristers (*Ordre des Avocats*) of the Parlement of Paris. He was admitted to this distinguished legal fraternity at an unusually early age in July 1764. Although he had no intention of pursuing a career in the law, he was aware of the social prestige associated with being a barrister; in the marriage contract he signed in December 1771 the first of the corporate affiliations by which he is identified is that of barrister.²

Lavoisier had not neglected his scientific interests during his years in the faculty of law. While a law student he studied with several of the prominent scientists who offered both public and private courses in Paris. But a young man hoping to make a name for himself in science had to be concerned about the social organization of science as well as its cognitive content. In the summer of 1764 Lavoisier therefore shrewdly focused his attention on gaining a place in an institution that would provide the kind of support he needed. He was looking for an established corporation or office that would make available instruments and other forms of material support and would also provide a forum to which he could report his findings. It was important to a man of his ambition that this institution be of such high social standing that those who distinguished themselves within it would be recognized by the world at large as leading scientists. The institution he chose was both obvious and perfectly suited to Lavoisier's vision of his future; in the summer of 1764 he began his campaign for admission to the Royal Academy of Sciences in Paris (*Académie Royale des Sciences*).

The Academy was at that time conducting a public competition on the question of how best to illuminate city streets. Lavoisier quickly decided this topic offered him a perfect opportunity to display his talent as an experimenter and his commitment to using scientific knowledge for the public good. By August 1764 he was hard at work on an extended series of experiments on the construction, fueling, and placement of street lamps.³ The essay he composed and submitted to the Academy after many months of strenuous effort contains abundant evidence of his dedication, ambition, and talent, and the Academy of