that "usually Galileo was not attacked because he was a Copernican but because of his (and his discoveries') extreme visibility and his success in becoming the mathematician and philosopher of the Grand Duke". In 1611 Galileo was welcomed at the Collegio Romano, the Jesuit University in Rome, where his telescopic observations were publicly praised — praise worth having, because the Jesuits, among whom were some of the best scientists in Europe, had made their own telescopes and confirmed Galileo's discoveries of craters on the Moon and satellites around Jupiter. We are now told, however, that Galileo's Roman Triumph "should be understood in terms of his connection to the Medici" and that he went to Rome as their "official envoy". The reason is that the government of Tuscany paid his travel expenses. On these grounds, shouldn't British scientists' lecture tours and attendance at meetings be "understood" in terms of the policy of the Royal Society?

Biagioli is more convincing when, in the footsteps of R. S. Westfall, he traces the relationship of Galileo with Prince Cesi, the founder of the Accademia dei Lincei, which Galileo joined in 1611, the year of his great success in Rome. As Galileo's patron, Cesi steered the *Letters on the Sunspots* (1613) and *The Assayer* (1623) through the shoals of Roman censorship and had them published at his own expense. Galileo hoped that he would also smooth, financially and otherwise, the path of the *Dialogue on the Two Chief World Systems*, but the Prince's death in 1630 deprived him of this influential friend and protector.

Biagioli's emphasis on patronage is also helpful in understanding the reaction of Pope Urban VIII to the publication of the *Dialogue* in 1632. The pope had treated Galileo with warmth and friendliness, and he expected to be repaid with courtesy and deference. The Roman censor had enjoined Galileo to mention the pope's view on the relativity of scientific theories and the impossibility of knowing with absolute certainty whether a given theory is more than a useful hypothesis. Galileo complied to the extent of stating this opinion (which he ascribes to "a most learned and eminent person") at the end of his book. Unfortunately, he puts it in the mouth of Simplicio, the Aristotelian pedant who cuts such a sorry figure throughout the entire *Dialogue*. Pope Urban VIII was personally affronted and bore Galileo a grudge to his dying day. Such bitterness might seem unbecoming for the Head of Christendom; Biagioli shows that it was comprehensible in a seventeenth-century patron. □

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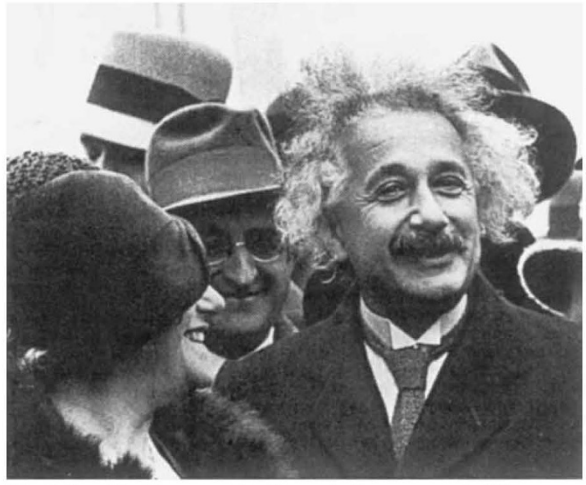
Relative values

Arthur I. Miller

The Private Lives of Albert Einstein. By Roger Highfield and Paul Carter. *Faber and Faber: 1993. Pp. 355. £14.95.*

LIFE can be complicated, especiallly in matters of the heart. So we ought not to be surprised that this was also true for Albert Einstein. Roger Highfield and Paul Carter have used Einstein's personal correspondence, some of it discovered as recently as 1986, to produce a narrative that reveals him to have experienced *angst* and joys not uncommon to most mortals.

But would this book have the same interest if we removed the name Albert Einstein? Let's do that and see what remains. We have the story of a pre-college student who falls madly in love, writes syrupy love letters to his beloved and courts her vigorously until she professes her love for him. Having achieved his desired end he beats a hasty retreat, preferring action at a distance. Finally the going gets too much and he ends the relationship.



Bildarchiv Preussischer Kulturbesitz

Einstein with his second wife and distant cousin Elsa.

Our 'hero' goes on to university where he falls in love (again) and a tumultuous love affair ensues, love letters and all. Being no Lord Byron, these letters are essentially the same as the previous ones. So is his preference for action at a distance once his girlfriend falls madly in love with him. He has doubts but doesn't want to lose her, preferring passionate reunions to a day-to-day relationship.

Both parents strongly oppose the liaison, his more than hers. He graduates from university, she does not. The plot thickens when the girlfriend becomes pregnant and, though he seems mildly enthusiastic about the baby, work comes first. They put the child up for adoption before he does the 'decent' thing and marries her. Their close relationship is renewed with her totally dependent on him but he buries himself even deeper in his work. Then another child arrives, she becomes jealous of his friends and of any extra-familial activities and now the couple who could not live apart discover they cannot live together. He becomes unexpectedly successful and is offered positions elsewhere and expects her to move with him along with their two children. He feels suffocated by the relationship, while she takes refuge in the children. Sounds familiar? Let's continue.

A distant cousin 'on the prowl' arranges a meeting and the married man indulges himself. A liaison follows, as do love letters of course. A major position opens in the cousin's home town, which he accepts; the wife refuses to go. After the divorce our by now fantastically successful figure marries the cousin. He becomes bored and is distracted by the attentions of other women. The middle-aged man embarks on affairs — some with love letters, of course. Meanwhile the children from the first marriage have nothing but scorn for the second wife, seeing in her the miseries of their mother, still in love with the image of the passionate young man from her vanished youth.

With Albert Einstein as the central figure, this scenario takes on added interest. Einstein did more than create scientific theories that changed our view of nature; with Sigmund Freud he created the twentieth century. What is so amazing is that Einstein's most creative years were the ones spent in the Swiss Federal Patent Office in Berne, 1902–09, where he worked full time in addition to publishing about 50 scientific papers. Among them are the special theory of relativity and the groundwork for the general theory. Consequently, our eyes widen when, in the midst of a love letter to Mileva Marić in 1901, his college sweetheart and then first wife, he mentions "our work on relative motion". Passages such as this have led to the suggestion that Mileva deserves some of the accolades for special relativity. The authors review conclusive evidence to the contrary.

Highfield and Carter have an agenda: to smash an icon. So, for example, they spend an entire chapter on the 16-year-old Einstein's relationship with his first girlfriend, accusing him of being hypocritical for rejecting her pleas to spend more time together and then citing hearsay evidence from years later that he bears the blame for her subsequently unhappy life.

Similarly, Einstein is linked indirectly with Mileva's academic failures. There is even a suggestion by the authors that Einstein beat Mileva. Sometimes the authors cite conflicting evidence for Einstein's extramarital liaisons during his second marriage to cousin Elsa. For example, after recounting a number of Einstein's liaisons during the 1920s in Berlin they quote Konrad Wachsmann, the architect who designed Einstein's summer house at Caputh (where some of the romantic meetings occurred), to the effect that the liaisons were "almost without exception" platonic. The authors do cite convincing evidence for certain of Einstein's affairs. In general their strategy is to weave selected passages from correspondence with reminiscences of Einstein from sometimes more than 40 years earlier in order to paint an unflattering picture.

Let's assume all this is true. Does it add to our understanding of Einstein' creativity or his science? This point is never addressed. Highfield and Carter are uninformative on such key issues and generally on what Einstein was up against scientifically in 1905. As a consequence, their narrative lacks the key line that they are telling us about a central figure in the history of ideas. It is like writing about Winston Churchill's life during 1940–45 without mentioning the Second World War. The authors offer us a disembodied figure, who becomes the subject of tabloid sensationalism. After all, maybe the worst possible scenario for Einstein's personal life was essential for his creativity, like Picasso's?

The titillating sensationalistic aspects of Einstein's correspondence aside, the critical portion for serious researchers interested in scientific creativity and not gossip, innuendo and rumour, are the early letters to Mileva (snippets are quoted by Highfield and Carter along with their interpretations — for the complete letters see J. Renn and R. Schulmann (eds) *Albert Einstein and Mileva Marić: The Love Letters*, Princeton University Press, 1992; for a review, see *Nature* **360**, 377–378 (1992)), in addition to other material relating to his life during 1902–09. With proper analysis they could reveal how his personal life affected his scientific work. Is this not what we expect of the artist, musician or writer? Einstein's life as a young man is the stuff of which movies are made. □

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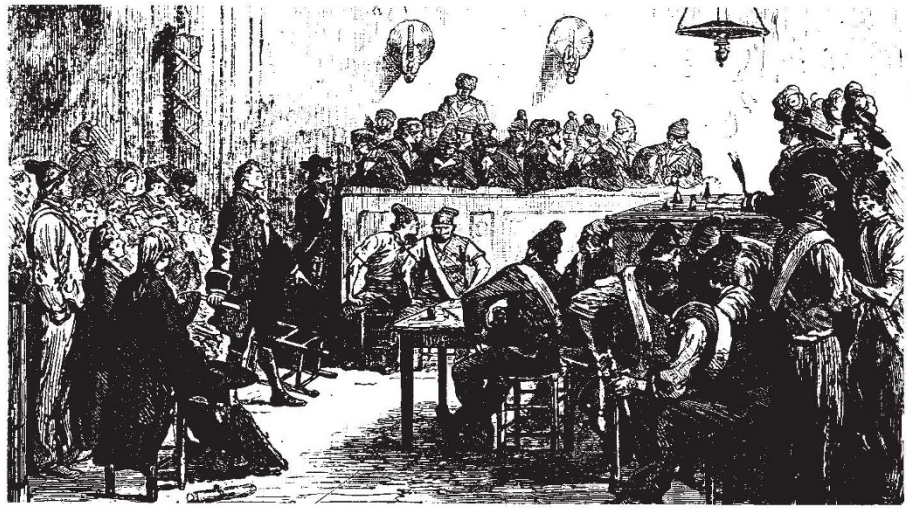
■ *Einstein: A Life in Science* by Michael White and John Gribbin has just been published by Simon and Schuster, price £16.99. □

Science's new language

David Knight

The Enlightenment of Matter: The Definition of Chemistry from Agricola to Lavoisier. By Marco Beretta. *Watson Publishing International: 1993. Pp. 396. $49.95.*

LAVOISIER was beheaded in May 1794, and the event will be marked, if not celebrated, by conferences and publications, of which Marco Beretta's is one of the first. He is an Italian working in Sweden and writing in English, and has an excellent command of the French sources; he is therefore excellently placed to emphasize the new language that Lavoisier provided for chemistry, and its spread throughout Europe in the years between 1787 and 1800. Torbern Bergman and Guyton de Morveau have both in the past been given much of the credit for the new nomenclature, and Lavoisier's associates preferred to think of the new chemistry as a collective French achievement. But Beretta sees the achievement as essentially Lavoisier's, and the new language as crucial rather than as a convenient appendage to a new theory.



Mary Evans

Lavoisier before the revolutionary tribunal that sentenced him to the guillotine in 1794.

Lavoisier's great *Traité élémentaire de chimie* appeared in 1789, and he was very conscious that his chemical revolution was simultaneous with the political revolution around him. This eventually cost him his life, as a prominent and extremely wealthy tax collector. Indeed, this was the first major transformation in the sciences to be described by participants as a revolution. The idea that such sharp discontinuities, like the catastrophes prominent in the geology of Lavoisier's period, make up the history of science is a crucial feature of Thomas Kuhn's philosophy of science. He stresses the differences in the terms and very language used before and after some heroic figure has transformed a science, accounting for earlier anomalies and persuading his colleagues to see things his or her way. This makes Lavoisier's revolution, where a new language was devised to transform a Baconian science into one having a clear and deductive structure, particularly instructive — perhaps indeed paradigmatic. Certainly Lavoisier's approach, example and language formed what Kuhn calls the paradigm within which the next generation worked.

Nevertheless, most students of the period have concentrated on Lavoisier's demonstration that the older view, that anything that would burn contained phlogiston, was incoherent. He replaced this with the theory that burning meant combination with oxygen, which had at first been called vital air, or eminently respirable air, or dephlogisticated air. Beretta emphasizes Lavoisier's respect for G. E. Stahl and his phlogiston theory, which had brought order into chemistry and formed a necessary stage in its development; and his preoccupation with scientific language. In the *Traité*, there is reference to E. B. Condillac and his writings on language, which were developed from those of John Locke; but for Beretta this is a clue to a most important part of Lavoisier's thinking.

In 1787 the treatise *Nomenclature chimique* was published, with Guyton's name first in the list of authors, and Lavoisier's second; it has often been supposed that this indicated their importance, but Beretta shows that the four authors were in fact listed in order of age. For him, this book represents Lavoisier's scheme, beautifully calculated to make the new theory palatable, and indeed almost inevitable; but very bold. One of his exemplars was Linnaeus, whose system of naming plants and animals had brought order into natural history. Linnaeus based his procedure on external characters: