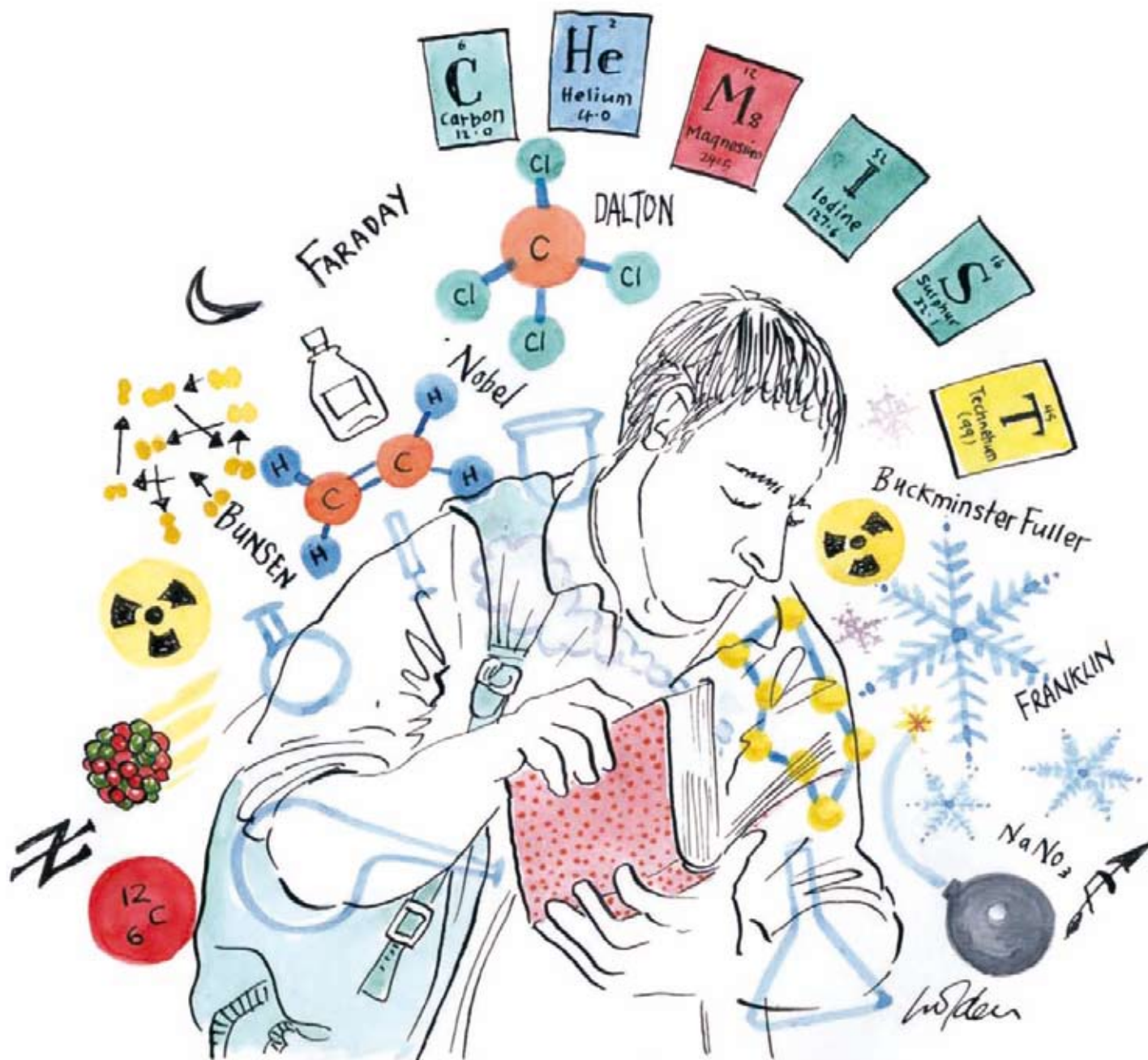


Literary reactions

Chemistry makes occasional appearances in fiction but rarely takes centre stage. Philip Ball unearths chemistry's fictional roles



CAROLINE HOLDEN

C P Snow's 1959 Rede lectures on the breakdown of communication between 'the two cultures' of science and the humanities now sound in many ways like the gripes of another era. While science may have been disdained by the literary giants of Snow's time – and even that is not universally true – today it is seized avidly by many novelists as a source of metaphor and inspiration. Ian McEwan weaves cosmology into *The child in time*, Martin Amis reverses time in *Time's arrow*, Jeanette Winterson incorporates grand unified theories into *Gut symmetries*, and Margaret Atwood portrays a biotechnological dystopia in *Oryx and Crake*.

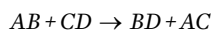
But who writes about chemistry in novels? True, you can find ample passing references in science fiction, from H G Wells' toxic compounds of argon concocted by Martians in *War of the Worlds* to Neil Stephenson's diamondoid nanotechnology in *The diamond age*. But these are not conceptual elements of the plot. Does chemistry have anything to offer the modern writer beyond a means of bumping off characters in crime thrillers?

Chemical marriages

Discussions of chemistry in fiction invariably begin with Johann Wolfgang von Goethe's 1809 novel *Elective affinities*, and with good reason: seldom has a chemical metaphor been made more explicit. The story centres on four characters. Eduard and Charlotte languish in an affluent but stultifying marriage of convenience on a country estate, and invite to live with them 'the Captain', a childhood friend of Eduard's, and Otilie, a beautiful young woman who is the orphaned daughter of Charlotte's dead friend. You don't need to be clairvoyant to anticipate what happens: it is a kind of human double displacement reaction, as Eduard falls in love with Otilie while the Captain develops a relationship with Charlotte. Goethe ensures that we don't miss the point, spelling it out with textbook precision:

'Provided it does not seem pedantic,' the Captain said, 'I think I can briefly sum up in the language of signs. Imagine an A intimately united with a B, so that no force is able to sunder them; imagine a C likewise related to a D; now bring the two couples into contact: A will throw itself at D, C at B, without our being able to say which first deserted its partner, which first embraced the other's partner.'

This is shown below:



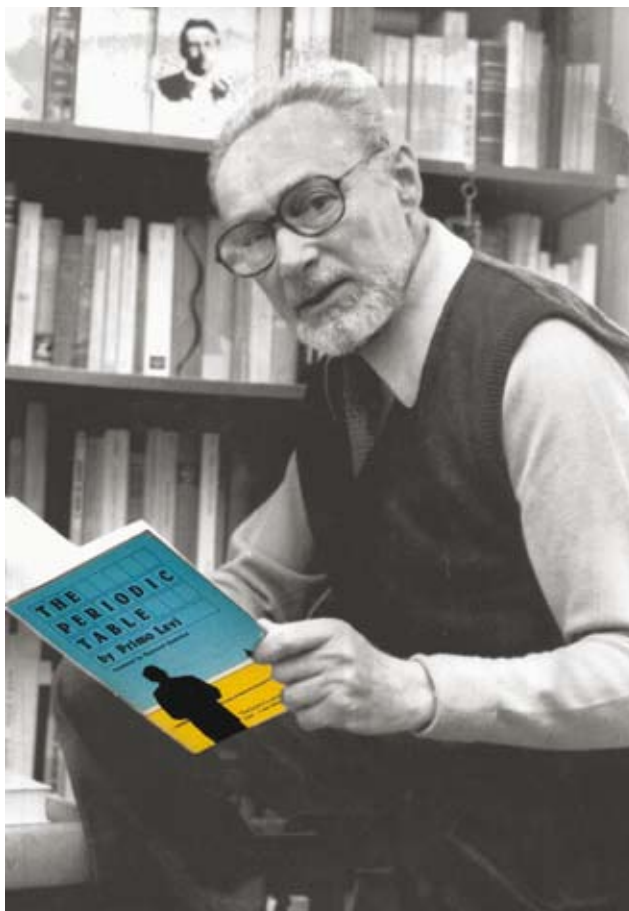
'Now then!' Eduard interposed: 'until we see all this with our own eyes, let us look on this formula as a metaphor from which we may extract a lesson we can apply immediately to ourselves. You, Charlotte, represent the A, and I represent your B; for in fact I do depend altogether on you and follow you as A follows B. The C is quite obviously the Captain, who for the moment is to some extent drawing me away from you. Now it is only fair that, if you are not to vanish into the limitless air, you must be provided with a D, and this D is unquestionably the charming little lady Otilie, whose approaching presence you may no longer resist.'

The 'affinities' of the title refer to the pre-eminent theory of the time for chemical reactivity, which was ascribed to precise but differing degrees of affinity between the elements. Eighteenth century chemists drew up 'affinity tables' summarising what was known about the laws of chemical composition. Affinity was often imagined as a kind of chemical force akin to Newtonian gravitation, giving chemistry the

In short

- Chemistry has made brief appearances in fiction since the 1800s but rarely takes centre stage
- In his 1809 novel, Wolfgang van Goethe created a chemical metaphor for human relationships
- Primo Levi is often credited with making chemistry accessible to non-chemist readers
- Few authors have followed Goethe and Levi by tapping into chemistry's rich source of literary metaphors

Primo Levi reading a copy of his book *The periodic table*



appearance of a unified and exact science. Goethe, whose own scientific interests are widely known, made laborious use of this metaphor. 'The affinities become interesting only when they bring about divorces,' says Eduard. Charlotte answers him: 'Does that doleful word, which one unhappily hears so often in society these days, also occur in natural science?' 'To be sure', Eduard replies. 'It even used to be a title of honour to chemists to call them artists in divorcing one thing from another.'

It has been debated whether Goethe in fact intended all this as mere metaphor, or whether he thought there really were fateful forces that governed the relationships between people. Certainly the sociologist Max Weber, who read Goethe's work, used the term 'elective affinity' in the early twentieth century to describe specific attractions that he perceived in social phenomena, for example between Protestantism and capitalism.

But Goethe's use of chemical analogies in literature wasn't as new as is sometimes implied, since alchemy had long been a source of inspiration to artists, writers and poets. It's been suggested that alchemical imagery lies at the core of several of Shakespeare's works, most notably *King Lear*, where the tribulations of the king can be seen as symbolising the transformations in alchemy that were supposed to produce the 'Red King', a substance en route to the Philosopher's Stone. Alchemical metaphors for romance were particularly common in the Elizabethan age – two of Shakespeare's sonnets are based on imagery connected to the Aristotelian quartet of elements – and in some ways Goethe's tale could be regarded as updating, to the science of his day, the old notion of the chemical marriage – the union that was supposed to take place in the alchemical crucible between 'male' and 'female' principles to create the fictitious Stone. John Donne wrote of 'love's alchymie', and he draws on the sexual union of the chemical marriage in his poem *The comparison*, written in the 1590s:

*Then like the Chymicks masculine
equall fire,
Which in the Lymbecks warm wombe
doth inspire
Into th'earths worthlesse durt a soule
of gold,
Such cherishing heat her best lov'd part
doth hold.
(‘Lymbeck’ here is the alchemist’s*

alembic.) Donne and Shakespeare both wrote during the age of ‘chemical philosophies’ – entire world views based on alchemical theories – when it seemed natural to interpret all worldly events in chemical terms in a manner that went beyond mere metaphor.

Curiously, the alchemical quest to make gold often becomes substituted, in more recent fiction, with a quest to make diamonds – as though, with the demise of alchemical theories of metals, this instead became emblematic of chemistry’s quest to surpass nature. The German writer Jean Paul provided perhaps the earliest example of the diamond-maker in his book of 1820–22, *Der komet oder Nikolaus Marggraf*, and H G Wells’ eponymous hero in *The diamond maker* (1894) is the stereotype of the medieval alchemist, who almost ruins himself in his obsessive quest and fails to profit from it even when it succeeds. Even Primo Levi used this trope in his short story *Order on the cheap*.

A Faustian legacy

Elective affinities was not the beginning of any trend; it remains an oddity, a more or less unique attempt to create modern fiction from chemical themes. If we seek chemistry in literature between then and now, we generally tend to find it used much more straightforwardly, as a bit of science that somehow serves the plot – as in, to take a random example, the art forger’s chemical art in Robertson Davies’ *What’s bred in the bone* (1985). One could even say this is true of Mary Shelley’s *Frankenstein*, published just a few years after Goethe’s novel, where it’s easy to forget that it is chemistry that brings the monster to life. ‘Chemistry,’ says Victor Frankenstein’s mentor Dr Waldmann of the University of Ingolstadt, ‘is that branch of natural philosophy in which the greatest improvements have been and may be made.’ It is clearly implied that a form of galvanic electrochemistry, a hot topic when Mary Shelley wrote the book around 1816, is what infuses ‘a spark of being into the lifeless thing’.

But there is more to the chemistry in *Frankenstein* than a bit of vogueish science. The story is basically a retelling of the Faust myth, in which a hubristic knowledge seeker unleashes powers he can’t control. It was Goethe himself who gave this myth a modern face, making Faust a tragic figure rather than, in the earlier medieval tradition, a bungling charlatan. And Faust always uses what is perceived as



the most powerful science of his time, which is why Christopher Marlowe’s Faust, in his 1594 play which was again a product of the chemical philosophies, is interested in alchemy, while Shelley’s is a chemist. The twentieth-century retellings of hubristic scientists, meanwhile, such as Dr Strangelove and the faceless labcoats whose botches create B-movie monsters, make them nuclear scientists; today’s Fausts and Frankensteins are biotechnologists and geneticists (think of *Jurassic park*). For better or worse, chemistry soon disappears as the central plot device in this particular strand of science in fiction.

But there is one notable exception. Thomas Pynchon’s *Gravity’s rainbow* (1973) is almost without parallel in the way it engages with the place of chemistry in the modern world. Admittedly, it’s no mean feat to discover this, because Pynchon’s huge novel is one of the densest, most labyrinthine and peculiar works of the late twentieth century. If you’re used to a coherent plot with a beginning, middle and end, and to literary staples such as character development, you’re in for a shock. The story, such as it

Chemistry brought Mary Shelley’s Frankenstein to life

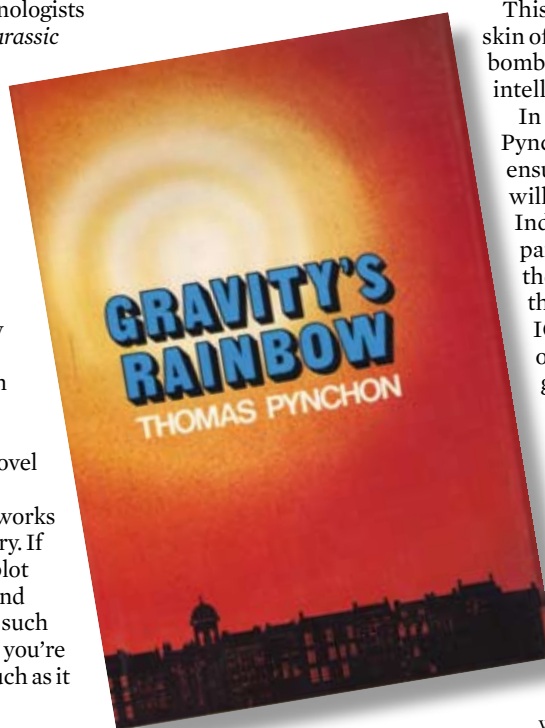
is, is almost impossible to summarise, but revolves around the journeys of US army lieutenant Tyrone Slothrop through Europe at the end and in the aftermath of the second world war, as he stumbles over the genesis and the intended future of the German V2 technology. A more conventional and less informed writer would doubtless have bound all this up with nuclear physics and the start of the Cold War. But Pynchon instead makes the architect of rocket technology a shady, trans-national industrial–military complex centred on the German chemical cartel IG Farben, manufacturer of the notorious poison gas Zyklon B. Its ominous schemes were set in motion by a chemist named Laszlo Jamf, an intellectual descendant of August Wilhelm Hofmann, who seems to have been a specialist in organic and polymer chemistry.

Jamf is the mad scientist in his icy Dr Strangelove guise. He is said to have invented a mysterious polymer called Imipolex G, a material that seems to change its properties in response to electrical stimuli and become, wickedly, erectile:

Under suitable stimuli, the chains grow cross-links, which stiffen the molecule and increase intermolecular attraction so that this Peculiar Polymer runs far outside the known phase diagrams, from limp rubbery amorphous to amazing perfect tessellation, hardness, brilliant transparency, high resistance to temperature, weather, vacuum, shock of any kind.

This was to be the smart skin of a new type of rocket bomb that is almost creepily intelligent.

In *Gravity’s Rainbow*, Pynchon feels no need to ensure that his readers will follow all the science. Indeed, it is arguably part of the point that they won’t, making it all the more apparent that IG Farben possesses occult knowledge that gives it the power to manipulate history. Pynchon pulls this off (in my view) because he himself knows what he is talking about: he studied engineering physics at Cornell in the 1950s, and later worked at Boeing.



Chemistry for better living?

All this might dismay the chemist who is sick and tired of being cast as the callous enemy of public health and safety. But I don't believe that Pynchon intended any such simplistic diatribe. His target was the military-industrial complex, not the science *per se*. And he had the insight to see that chemistry was central here, precisely because it is such an applied science.

A rather similar picture is presented by American author Don DeLillo in his 1984 novel *White noise*, where the life of the Gladney family in middle-class Middle America is permeated and dominated by the textures and products of modern chemistry, from pills for every imagined ailment to synthetic fabrics with cryptic names like Mylex. The story pivots around a chemical accident, an 'airborne toxic event' involving a carcinogen called Nyodene D.

Again, this is no anti-chemistry diatribe, but a study of the almost mythic dimension that the products of modern chemistry have acquired. That too is a theme of Richard Powers' 1998 novel *Gain*, which has dual narrative strands. One tells of the origins and evolution of a chemical company called Clare, from its beginnings as a candle- and soap-making business of two Irish immigrants in Boston to a multinational rival of Lever and Procter & Gamble. The other describes the decline and death of a real-estate agent in Illinois called Laura Bodey, whose ovarian cancer may or may not be linked to the proximity of Clare's chemical works.

Even more than Pynchon, Powers embellishes his account with chemical details, to the extent of showing the reactions of the Leblanc process for converting sodium chloride into soda, and a diagram depicting the various uses of Glauber's salt (sodium sulfate). And again the message is complex, for chemistry is shown as a saviour as well as a potential killer – Laura is prescribed semi-synthetic taxol, and her son becomes an expert on protein folding for drug development. The message is not about the evils of chemistry, but about the double-edged sword of a consumer society. 'People want everything,' whispers the terminally ill Laura. 'That's their problem.'

Chemistry's poet

Set against all of this is the writer who, along with Goethe, is bound

to crop up in discussions of chemistry in fiction: Primo Levi. He is now virtually the patron saint of chemistry writing, whose 1975 book *The periodic table* is credited with making chemistry accessible to countless readers who would otherwise have run a mile from the subject. *The periodic table* is not a novel as such, but a series of vignettes and sketches, many of them autobiographical, that are somehow based around a chemical element. The last of these is explicitly pedagogical, but poetic enough never to feel that way: in *Carbon*, Levi traces the progress of that element through its natural biogeochemical cycle.

To my mind, Levi's novel *The monkey's wrench* (1978) contains a considerably more explicit and elegant depiction of what chemists do: 'we rig and dismantle very tiny constructions'. His chemist narrator relates how difficult it is to get all the parts in the right place, and how crude many of the shake 'n' bake methods are. He fantasises about having delicate 'tweezers' that now sound remarkably like the atomic-probe microscopes, invented only a few years after the book was written, which can pick up atoms and push bits of molecules into shape.

The book is rather less compelling as fiction, however, perhaps because its autobiographical elements are more filtered and disguised. Nothing can equal the narrative and moral power that Levi brings to his accounts as a survivor of the concentration camps, glancingly in *The periodic table* but in detail in

'How nice it would be to find the ideas of chemistry take centre stage'

Oliver Sacks interweaves chemistry and humanity in his autobiographical *Uncle Tungsten*

If this is a man. It was his training as a chemist that saved his life when he was selected to work as an assistant in IG Farben's Buna-Werke laboratory at Auschwitz, making synthetic rubber in an eerie resonance with Pynchon's fable.

Levi's stories in *The periodic table* delight in the materiality of chemistry: sodium, he explains 'is neither rigid nor elastic; rather it is soft like wax; it is not shiny or, better, it is shiny only if preserved with maniacal care'. The book is unique in actually explaining some chemistry, which should ordinarily never be the reason for putting science into fiction. Oliver Sacks achieves a similar interweaving of chemistry and humanity in his autobiographical *Uncle Tungsten* (2001).

Not just a villain?

An optimistic reading of these diverse examples of chemistry in fiction would suggest that they offer a more nuanced vision of chemistry than that perpetuated in media scare stories about the terrible things that 'chemicals' in our environment threaten to do to us. To my mind, linking chemistry to modern culture, with all its consumerist excesses, is potentially a good rather than a bad thing; it allows a writer like Richard Powers to show that the problems stem from the way applications are chosen and implemented, and moreover that 'evils' such as toxic spills and contamination of remote ecosystems are the flipside of the immense benefits that chemistry has conferred on society. Fiction offers opportunities for exploring these complex issues without resort to the polarities and simplifications typical of journalism.

But science in fiction can surely do more than provide a vehicle for debating its applications. Physics and biology appear to offer rich sources of literary metaphor, poetic imagery and allusion. Goethe and Levi have made the case that chemistry can do so too, yet they are unusual in that, if not perhaps unique. No doubt readers of *Chemistry World* would welcome books in which chemists are the heroes and not the villains. But how much nicer it would be to find the ideas of chemistry take centre stage, as alchemy did in some Elizabethan poetry. Who will take up the challenge?

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