FICTION

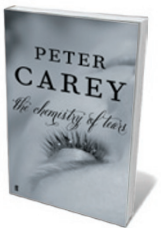
Wondrous machines

A multilayered tale centred on a nineteenth-century automaton grips **Minsoo Kang**.

Artificial beings throng myth and literature. Science fiction, for instance, has specialized in robots, androids and cyborgs — creatures often associated with a kind of high-tech utility. (The word 'robot', coined by the Czech writer and artist Josef Čapek, stems from the word for 'drudgery' in several Slavic languages.) Literary writers from Herman Melville to Thomas Pynchon, however, have been drawn more to automata, mechanical simulacra of living beings that proliferated in the eighteenth and nineteenth centuries, before electric and digital technology. Designed as devices of wonder and beauty, automata lend themselves to the aesthetic and symbolic.

Now, in his wonderful *The Chemistry of Tears*, Australian writer Peter Carey ponders the automaton through the eyes and thoughts of human characters. This multilayered novel follows the lives of two people separated in time but involved with one mechanical being — based on Jacques de Vaucanson's Defecating Duck, a famous eighteenth-century automaton. The book is dominated by the alternating narratives of the protagonists, a modern museum specialist and a Victorian father on a fraught personal quest, but the cast also includes an inventor with echoes of Charles Babbage — a nineteenth-century mathematician and engineer who restored automata as well as designing a proto-computer, the difference engine.

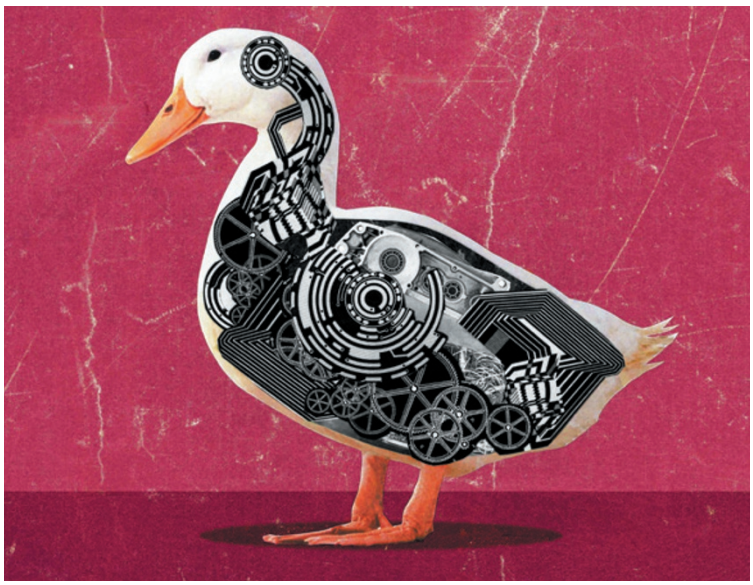
The Chemistry of Tears follows the Western tradition of using the automaton as a conceptual object for pondering the nature of humanity — a tradition now surfacing in debates about biological determinism and free will, the nature of 'digitized' humans and bioengineered 'DNA robots'. Are we essentially organic automata constructed by some creator? Can we engineer self-aware artificial beings capable of experiencing emotions and making moral decisions? What part of our humanity lies beyond the material world and can never be replicated artificially? Rather than providing easy answers to such questions, Carey presents a narrative that demonstrates their complexity.



The Chemistry of Tears
PETER CAREY
Faber and Faber/ Knopf: 2012. 288 pp. £17.99/$26

First, we meet Catherine Gehrig, a restorer of clocks at a London museum. While mourning the sudden death of her married lover, she is given the task of reassembling an automaton, a nineteenth-century replica of Vaucanson's duck. The parts are presented to her along with the notebooks of Henry Brandling, who commissioned the device. Through Catherine's reading of Brandling's story we follow the second narrative, of his attempt to cheer his ailing son by travelling to Germany and finding a mechanic to recreate Vaucanson's automaton.

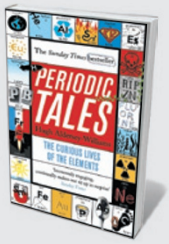
The real Defecating Duck was an astonishingly lifelike device with hundreds of moving parts. It could flap its wings, eat and, as its name implies, even produce droppings. Vaucanson first presented it to the Parisian public in 1738, along with two mechanical human figures: the Flute Player and another playing a fife and drum. They were such a financial and intellectual success — praised by luminaries including Voltaire and Denis Diderot — that they set off a century-long automaton craze. The duck itself passed through the hands of multiple owners and toured Europe, until it ended up, dilapidated, in the German town of Helmstadt, where writer and physicist Johann Wolfgang von Goethe saw it in 1805.



DUCK: GETTY; ILLUSTRATION: MARTIN O'NEILL

Throughout the beautifully told stories of Catherine's grief and Henry's quest, Carey plays with the concept of the automaton metaphorically and symbolically. Catherine, in her distress, describes herself as a "whirring, mad machine", and later remembers how she and her lover had thought of themselves as "intricate chemical machines". The desperation of Henry's search stems from his hope that the recreation of Vaucanson's

The Way of the Panda: The Curious History of China's Political Animal
Henry Nicholls (Pegasus Books, 2012; $15.95)
The panda's cultural history is interwoven with China's development as a global power. The beast's iconic status is double-edged: it is both conserved and hunted, says journalist Henry Nicholls. (See Jane Qiu's review: *Nature* **468,** 503–504; 2010.)



Periodic Tales: The Curious Lives of the Elements
Hugh Aldersey-Williams (Penguin, 2012; £9.99)
Science writer Hugh Aldersey-Williams's cultural history traces chemical elements that have gone in and out of fashion, such as aluminium — once favoured for royal tableware. (See Andrew Robinson's review: *Nature* **470,** 170–171; 2011).

animate duck could somehow heal his beloved son's ill body.

Catherine follows Henry's misadventures in Germany in her increasingly obsessive reading of his notebooks. His story takes a fairy-tale turn as he is led to Furtwagen, a small town in the Black Forest, by a mysterious man named Sumper, who claims to possess the skills to recreate the avian automaton. With a trio of eccentrics — a collector of fairy tales, a preternaturally gifted child and his superstitious mother — Henry listens sceptically to his host's fantastic story of his own travels to England.

In a brilliant narrative turn, Carey uses this third storyline — Sumper's time in England as assistant to Albert Cruickshank, the inventor based on Babbage — to meditate on the automaton as a concept that lies at the heart of modernity. Whereas Enlightenment devices were aesthetic objects demonstrating the wonders of mechanical craft, the technology of the Industrial Revolution was deployed pragmatically to create ever more powerful engines and productive factories, and to expand empires. The process of modernization took what was useful from the beautiful automata and created the world of steam, smoke and industrial machines.

Catherine's efforts to rebuild Sumper's automaton (which turns out to be a swan, in a possible nod to Hans Christian Andersen's *The Ugly Duckling*), and Henry's desire to present a marvel from the previous century to his son, represent a wish to return to untroubled pasts, and to bring the dead and dying back to life, that mirrors the automaton-maker's role in breathing 'life' into inert materials. This deeply moving, intellectually profound novel on the heartbreaking grief of 'living machines' tells the story of the essential human desire to return to the individual Edens that we inhabited before we knew about the unavoidable pain of our mechanical lives. ■

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ECOLOGY

Trashed world

Sonja Vermeulen ponders two takes on the twinned global issues of consumption and waste.

Wasted World: How Our Consumption Challenges the Planet
ROB HENGEVELD
Univ. Chicago Press: 2012. 360 pp. $30, £19.50

Garbology: Our Dirty Love Affair with Trash
EDWARD HUMES
Avery: 2012. 288 pp. £16.90, $27

Consumption drives economies but threatens human existence. Two books deal with this global issue in diametrically opposed ways. Ecologist Rob Hengeveld's *Wasted World* is a monumental *cri de coeur*, echoing ground-breaking 1970s thinking on the issue. But Pulitzer-prizewinning journalist Edward Humes' *Garbology* delivers hard facts and practical solutions.

The United States accounts for one-fifth of global consumption but only one-twentieth of the world's population. Humes focuses on how to reduce the average US citizen's lifetime legacy of 93 tonnes of refuse, using personal stories to draw out the wider social issues around waste management.

The usual approach, Humes observes, has been to make waste "appear to disappear". This is borne out by evocative examples such as the great Pacific garbage patch: not a continent-sized floating island of rubbish, as many imagine, but rather a "swirling sewer" of "barely visible particles circling endlessly". Humes shows how innovative clean-up technologies — such as an artificial 'beach' that collects fine marine debris but not sea life — can be part of the solution. But the more practical answer, he says, is to avoid creating the waste in the first place.

MARTIN O'NEILL

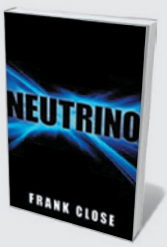
Reducing waste means consuming differently. Humes doesn't believe that profligate consumption is hard to shift. He sees humans as naturally thrifty, and points out that prodigious marketing has gone into creating modern consumer culture, down to the engineered 'preference' for plastic bags over paper ones. Not that Humes is anti-business: as in his book *Force of Nature* (HarperBusiness, 2011), he presents a balanced picture of the choices faced by major companies.

Key to Humes's 'can do' message are case studies of commercially successful innovations. Recycling company TerraCycle, for instance, was launched in 2001 by two students at Princeton University in New Jersey, who turned university food waste into organic fertilizer by feeding it to earthworms. Their start-up gained publicity from lawsuits lodged by a larger competitor contesting their advertising claims, even though they lost. TerraCycle is now one of the world's fastest-growing recycling firms.

Humes thinks that individuals can make a difference by simply saying no to unwanted stuff, and focusing on the cost of lifetime ownership rather than the purchase price. The pioneers of new attitudes towards waste, says Humes, are "ordinary people", not moralists or separatists. In this sense, his book is simultaneously reassuring and radical.

In *Wasted World*, Hengeveld's intellectual compass is firmly aligned with the powerful decades-old environmental rhetoric of thinkers such as environmentalist Donella Meadows (co-author of *The Limits to*

The Planet in a Pebble: A Journey into Earth's Deep History
Jan Zalasiewicz (Oxford Univ. Press, 2012; £9.99)
Palaeontologist Jan Zalasiewicz takes a pebble as the protagonist in a story of Earth's geology. He shows that even the most mundane piece of matter has a history that reaches across time and space to the beginning of the Universe.



Neutrino
Frank Close (Oxford Univ. Press, 2012; £7.99)
As you read this, you are being bombarded with neutrinos — the particle about which we know least. Physicist Frank Close recounts the hunt for the "commonest" and "weirdest" of the things that make up the Universe, and explains how following them could lead us to the farthest cosmos.