Oliver Rackham analysed interactions between people and woodlands.

NATURAL HISTORY

Voices from the greenwood

Caspar Henderson applauds a paean to the brilliant forest ecologist Oliver Rackham.

For too many years, I have been one of the rats running frequently along the motorway from Oxford through the Chiltern Hills into London. On the capital's outskirts, my bus sweeps past a scrap of land wedged between the road and a London Underground line, where an increasingly decrepit sign proclaims the future home of gleaming corporate headquarters. In reality, the site has, over time, turned from rubbish-strewn concrete to a dense young wood dominated by birch trees, some more than 8 metres tall. The last time I went by, on a bright, blustery autumn day, their tens of thousands of leaves caught the sunlight in a vision of glory.

This patch of self-willed wood might have raised a smile from botanist and historical ecologist Oliver Rackham. Over several decades until his death in 2015, Rackham probably did more than any other scientist to advance our understanding of the consequences of human interactions with woodlands and other landscapes in Britain. That contribution inspires and informs *Arboreal*, a beautiful, insightful anthology edited by nature writer Adrian Cooper. The more than 40 pieces by ecologists, educators, photographers, sculptors and writers, are highly diverse. Their common starting point is that

the perceptions, memories and imagination of individuals matter, and that without wonder and reflection, research and action are blind and blundering.

Rackham's insights remain compelling. With more than a dozen books, notably *Ancient Woodland* (Edward Arnold, 1980) and *The History of the Countryside* (J. M. Dent & Sons, 1986), he attracted and educated a large public. He showed that ancient woodland — any wood in continuous existence since at least 1600 — was frequently as much a human artefact as 'natural'. He helped to set in train significant changes to planning and conservation, fighting the Forestry Commission over the planting of uniform stands of conifers, and showing that large unmanaged populations of deer pose serious threats to woods. In his last years, he stressed the dangers of unregulated global trade in trees, a factor in the spread of pests and diseases.

Arboreal: A Collection of New Woodland Writing
EDITED BY ADRIAN COOPER
Little Toller: 2016.

His final book, *The Ash Tree* (Little Toller, 2014), explored the place of the much-loved genus *Fraxinus* in culture, and explained Chalara ash dieback, caused by the fungus *Hymenoscyphus fraxineus*, which threatens to wipe out a large proportion of this hitherto abundant species. (In 2012, dieback was reported to have affected some 90% of ash trees in Denmark, but Rackham withheld judgement about the probable scale of UK devastation.) Above all, Rackham helped to create a vision of woodlands as complex, dynamic and potentially resilient places that for thousands of years have seldom been free from human intervention, and where the stories we tell and choices we make have significant consequences.

Cooper calls this long relationship one of both estrangement and affection. Britain is among the most deforested countries in Europe: almost half the ancient woodland in the British Isles was either felled or poisoned between 1933 and 1983. Yet the country famously treasures its large ancient trees. "The majority of us do not own woodlands nor earn our living by them," Cooper writes in the introduction, "yet it seems that the trees and the woods still inhabit us."

So George Peterken, a woodland ecologist

of Rackham's generation, unfolds the surprises and paradoxes of what may be Britain's most 'natural' ancient wood, at Lady Park in the Wye Valley. Gabriel Hemery, forest scientist and author of *The New Sylva* (Bloomsbury, 2014; G. Hemery *Nature* **507**, 166–167; 2014), 'looks back' from 2050 on the reforestation of Dartmoor in the face of climate change.

Poet Kathleen Jamie brings the form and sensibility of classical Chinese poetry to the woodlands around Inshriach Bothy in Scotland's Cairngorms National Park. Jay Griffiths (author of *Wild*; Hamish Hamilton, 2007) unfolds the beauty in woodland birdsong, in prose of great energy and power. Sculptor David Nash explains how he created the extraordinary *Ash Dome* at Cae'n-y-Coed in Snowdonia, Wales. And in images such as one of leaf-fall through an opening in the New Forest canopy, photographer Ellie Davies creates a sense of immanence redolent of Andrei Tarkovsky's 1975 film *The Mirror*.

Elsewhere, Tobias Jones — co-founder of the Windsor Hill Wood project for young people with mental-health issues — makes a powerful case for the therapeutic use of woodland. He explores the Japanese practice of *shinrin yoku*, or forest bathing, and its reputed beneficial effects on insomnia and anxiety. Deb Wilenski, a specialist in early-childhood education, shows how Spinney Wood in Cambridgeshire can fire the imaginations of the very young to produce maps and poems (B. Kiser *et al. Nature* **523**, 286–289; 2015). And music journalist Will Ashon recounts the social history of Epping Forest — Britain's unofficial first national park and "a Cockney Paradise".

In *I Contain Multitudes*, an account of the microbiome (Ecco, 2016; A. Woolfson *Nature* **536**, 146–147; 2016), journalist Ed Yong describes dysbiosis. This process of irreversible decline triggered by perturbation from factors including antibiotics or pollution can afflict the human gut and other complex ecosystems, such as tropical coral reefs. *Arboreal*, which itself resembles a thicket of ancient woodland — unruly and pulsing with life, full of surprises and beauty in both detail and the long view — offers consolation and counsel for those who hope to save Britain's woods from such a fate. Trees are not, to paraphrase the poet and artist William Blake, green things standing in the way. They are living communities that are part of us, as we are still, in myriad subtle ways, part of them. ■

Caspar Henderson is the author of *The Book of Barely Imagined Beings*. His *New Map of Wonders* will be published next year.
e-mail: caspar81@gmail.com

BIOMECHANICS

The wonders of whirl

John E. Moalli and Adam P. Summers relish a book on biomechanical spin, from wheels to free-falling felines.

In *Why the Wheel Is Round*, biomechanist Steven Vogel (who died last year) succeeds once again in turning engineers, biologists and the general public onto the beauty, complexity and approachability of his field. He spins an 11-part tale of circular motion that ranges from rotation in biology to rotation driven by biology. Vogel captivates with discussions of engineering feats rooted in circular motion — from plodding horses turning shallow paddle wheels to gears that drive sixteenth-century reading machines — and doesn't stint on his trademark puns and word-play. Mixing findings in his own field with those from mechanics, dynamics and historical analysis, he creates a delightful perspective on the wonders of whirl. There is even a bonus chapter on how to make simple rotational models, including an entertaining but difficult-to-use drill. Let the good times roll.

The book begins with the lack of macroscopic wheels in biology — an area that Vogel touched on in *Cats' Paws and Catapults* (W. W. Norton, 2000). Notwithstanding whole organisms that tumble and spin, such as the tumbleweed and escaping wheel spiders (*Carparachne aureoflava*), Vogel points out that natural selection has been nearly incapable of producing a freely rotating joint. The only body part that can rotate unimpeded through more than 360 degrees is the bacterial flagellum.

Yet the usefulness and, in many cases, efficiency of rotational movement are such that Vogel proffers many biological examples of how linear motion is translated into rotational, as when contraction of muscle drives rotation of a beater to generate the aptly named *huevos revueltos* (Spanish for scrambled — literally 'revolved' — eggs).

From wheels and carts to bearings and shafts, cranks and drive mechanisms, each chapter is a historically informed circumambulation of an aspect or manifestation of rotation. For instance, which

Why the Wheel Is Round: Muscles, Technology, and How We Make Things Move

STEVEN VOGEL
University of Chicago
Press: 2016.

came first, the cart wheel, or the potter's wheel, used to fashion portable receptacles? (The answer revolves around the bearing.) The many period illustrations

are fascinating: you're compelled to work out the mechanisms of a mule-driven arrastra, a nineteenth-century ore crusher. Some reveal an ingenuity surprising for their era and encourage the reader to appreciate the simplicity with which engineers and designers tackle difficult tasks. The Italian engineer Agostino Ramelli's 1588 picture of an inclined turntable on which a miller would walk in place to turn grinding stones is one such. In other cases, the illustrations challenge your mechanical intuition. Two interlocking elliptical gears from a 1907 image by Gardner Dexter Hiscox look like they will simply jam when rotated. In fact, they turn a constant rotation into an output that is at first faster, then slower, than the input.

From the hidden rotation of a tape measure in its case, through 'true cranks' and treadmills, to how dough creeps up a spinning beater, there are lessons to be learnt. Vogel imparts a cheering numerical understanding, and outlines the possibility of new technologies that leverage under-appreciated concepts. One of these is the zero angular momentum turn — an apparent impossibility demonstrated by a cat righting itself during a fall. No angular momentum is imparted at the outset but, through contortions and twists, the feline reorients along its longitudinal axis.

This marvellous ability has never been exploited technically, but Vogel encourages speculation about use in robotics or micro-electromechanical systems. It might even serve as a metaphor for the elegance and ingenuity that make this book so fun to read. ■

John E. Moalli is a polymer engineer at Stanford University in California.
Adam P. Summers is a biomechanist at the University of Washington's Friday Harbor Labs.
e-mails: jmoalli@stanford.edu; fishguy@uw.edu

A hypothetical
sixteenth-century
reading machine.