EXHIBITION

The art of arthropods

Nick Thomas

A Californian entomologist uses insects as living paintbrushes to create abstract art. After loading water-based, non-toxic paints on to the tarsi and abdomens of insects, Steven Kutcher directs his bugs to create their 'masterpieces'.

Kutcher controls the direction and movement of his arthropods — such as hissing cockroaches (pictured), darkling beetles and grasshoppers — by their response to external lighting. The result is controlled and random movements, created in a co-authorship between the artist — with predetermined ideas about colour, form, shape and creative flexibility — and his living brushes.

Kutcher's art is more than just a novelty, because it reveals the hidden world of insect footprints. "When an insect walks on your hand, you may feel the legs move but nothing visible remains, only a sensation," he says. "These works of art render the insect tracks and routes visible, producing a visually pleasing piece."

An insect-lover from childhood, Kutcher has a master's degree in entomology and has taught biological sciences at various US colleges. Since the 1970s, he has worked as a 'bug wrangler' on some 500 movies, TV shows and advertisements, where he also used hair dryers, electric tape, and chemical repellents and attractants to control insect movement. He manipulated the tiny *Steatoda grossa* spider (painted blue and red) that nipped actor Tobey Maguire in *Spiderman*.

The idea for Kutcher's bug art originated in 1985, when he was hired to create fly footprints by making a fly walk through ink for an advertisement for Steven Spielberg's television series *Amazing Stories*.

J. ALCORN

This unique artist–arthropod partnership has so far yielded over a hundred works, typically characterized by vibrant, eye-catching colours and designs, splattered with trailing dots and dashes (see www.BugArtbySteven.com). Kutcher is now gathering pieces to form a travelling exhibit for art and natural history museums throughout the United States.

"I hope people will look at these works and see the duality of art and science," he says. "Each insect is writing a page in its life, and every painting is a new discovery." ■

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Kutcher's bug art is on display at the Entomological Society of America meeting in San Diego (9–12 December) and at the Lancaster Museum (15 December–13 January 2008), in California.

On a molecular mission

Elizabeth Blackburn and the Story of Telomeres: Deciphering the Ends of DNA
by Catherine Brady
MIT Press: 2007. 424 pp. $29.95/£19.95

Maria A. Blasco

"I want to understand how living things work," declared a young Liz Blackburn to Frank Hird, her supervisor at the University of Melbourne, when asked why she wished to pursue a scientific career. Back in the 1960s, Blackburn could not have imagined that she would later be the main player in two fundamental discoveries in biology: the molecular nature of the ends of chromosomes, or telomeres, and the identification of the enzyme telomerase.

Catherine Brady's biography is a page-turner from the first chapter, weaving together the heroine's personality with her success as a scientist. We learn about Blackburn's family and her first tentative steps in the science world that eventually led to the discovery of telomerase in the mid-1980s, and about her determination, her curiosity, her way of dealing with situations and her opinions on the peer-reviewing process.

In highlighting the factors that shaped Blackburn's career, we follow her incursions into policy-making and science ethics: first as president of the American Society of Cell Biology (ASCB) and as the chair of the Department of Microbiology and Immunology at the University of California in San Francisco (UCSF), and then as part of the Bioethics Advisory Council to President George W. Bush — from which she was dismissed for her views on stem-cell policy.

E. FALL

Arm arrangement: Liz Blackburn, discoverer of telomeres and telomerase, in her laboratory.

Blackburn has been an inspiration to those of us who started out in the field of telomeres. The book conveys a vivid impression of her that matches a personal encounter. Her equable temperament does not prevent her from having strong views, and she emerges as a valuable role model in the sometimes unsettling treatment of women in the world of science.

Born the second daughter of seven children in Tasmania, Australia, to a family of professional scientists (her parents were medical practitioners and her grandfather and great-grandfather were geologists in China). An early interest in chemistry and biochemistry propelled her to Hird's lab for her doctorate, which matured her forceful scientific mind and reaffirmed her interest in science as a *modus vivendi*. Then Blackburn went on to what at the time was the Olympus of molecular biology, the Medical Research Council (MRC) laboratory in Cambridge, a place packed with past and future Nobel laureates that would become the gold standard for today's top scientific institutions.

The MRC laboratory was hosting a revolution in molecular biology, powered by discoveries about cellular mechanisms fundamental to life. Fred Sanger's DNA-sequencing work particularly attracted Blackburn, and from him she learned her pragmatic approach to science. As Brady points out, the heady ambience of the laboratory was marred by some male chauvinism (with Watson and Perutz receiving special mention). Blackburn discovered how things

were in top scientific institutions: extreme dedication and long working hours, with no supporting hierarchies — what Brady calls a "rat lab". Fellow scientists became her family substitutes and friends, and there she met her future husband, John Sedat.

Blackburn's DNA-sequencing skills were for her the key to discovery, and she took them to Joe Gall's lab in Yale after a short break to climb to Mount Everest's base camp with Sedat. In Gall's lab were some of the future principals of the telomere field — Ginger Zakian, Mary-Lou Pardue and, later, Tom Cech. It was there that Blackburn discovered in 1976 that *Tetrahymena* chromosomes end in a series of repeated runs of cytosine bases that varied in length.

Although this was the first molecular insight into the structure of chromosome ends, it was not seen as important by the community, which is surprising in view of its implications for chromosome replication and transmission of genetic information. Blackburn blames the perception of *Tetrahymena* as a "freak organism". But it also fell outside what was then mainstream molecular biology. The story repeated itself when she, together with Carol Greider, discovered telomerase in 1985. By then it was clear that telomere replication was a fundamentally important process, but telomerase continued to receive scant attention until 1994–95, when it was shown to be aberrantly activated in most human cancers.

The biography succeeds in capturing Blackburn's vision, which has encouraged her to pursue unbeaten tracks to make discoveries that today hold therapeutic promise for both cancer and ageing. ■

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Is technology unnatural?

The Artificial and the Natural: An Evolving Polarity
edited by Bernadette Bensaude-Vincent and William R. Newman
MIT Press: 2007. 331pp. $40

Philip Ball

The topic of this book — how boundaries are drawn between the natural and the synthetic — has received too little serious attention, both in science and in society. Chemists are justifiably touchy about descriptions of commercial products as 'chemical-free', but the usual response, which is to lament media or public ignorance, fails to recognize the complex history and sociology that lies behind preconceptions about chemical artefacts. The issue is much broader, however, touching on areas ranging from stem-cell therapy and assisted conception to biomimetic engineering, synthetic biology, machine intelligence and ecosystem management.

And it is not an issue for the sciences alone. Arguably, the distinction between nature and artifice is equally fraught in what we now call the fine arts — where again it tends to be sidestepped. Some modern artists address the matter head on with their interventions in nature — for example, the artificial rainbows of Andy Goldsworthy — but much popular art criticism now imposes a contemporary view, even on the old masters. Through this lens, Renaissance writer Giorgio Vasari's astonishment that Leonardo's painted dewdrops "looked more convincing than the real thing" seems a little childish, as though he has missed the point of art. No one today believes that the artist's job is to mimic nature as accurately as possible. Perhaps with good reason, but it is left to art historians to point out that there is nothing absolute about this view.

At the heart of the matter is the fact that 'art' has not always meant what it does today. Until the late Enlightenment, it simply referred to anything human-made, whether a sculpture or an engine. The panoply of mutated creatures described in Francis Bacon's *The New Atlantis* (1627) were the products of 'art', and so were the metals generated in the alchemist's laboratory. The equivalent word in ancient Greece was *technē*, the root of 'technology' of course, but in itself a term that embraced subtle shades of meaning, examined here in ancient medicine by Heinrich von Staden and in mechanics by Francis Wolff.

The critical issue was how this 'art' was related to 'nature', roughly identified with what Aristotle called *physis*. Can art produce things identical to those in nature, or only superficial imitations of them? (The latter belief left Plato rather dismissive of the visual arts.) Does art operate using the same principles as nature, or does it violate them? Alchemy was commonly deemed to work simply by speeding up natural processes: metals ripened into gold sooner in the crucible than they did in the ground, and (al)chemical medicines accelerated natural healing. And although some considered 'artificial' things to be inferior to their 'natural' equivalents, it was also widely held that art could exceed nature, bringing objects to a greater state of perfection, as Roger Bacon believed of alchemical gold.

MUSEE FABRE, MONTPELLIER, FRANCE/GIRAUDON/THE BRIDGEMAN ART LIBRARY

Oil painting by Jan van Huysum (1682–1749): does art imitate nature, or improve on it?

The emphasis in *The Artificial and the Natural* is historical, ranging from Hippocrates to nylon. These motley essays are full of wonders and insights, but are ultimately frustrating in their microcosmic way. There is no real synthesis on offer, no vision of how attitudes have evolved and fragmented. There are too many conspicuous absences (Leonardo da Vinci for one) for the book to represent an overview.

It would have been nice to see some analysis of changing ideas about experimentation, the adoption of which was surely hindered by Aristotle's doubts that 'art' (and thus laboratory manipulation) was capable of illuminating nature. Prejudices about experiments often went further: even in the Renaissance, one was free to disregard their results if they conflicted with *a priori* 'truths' gleaned from nature, rather as Pythagoras advocated studying music by "setting aside the judgement of the ears". And it would have been fascinating to see how these issues were discussed in other cultures, particularly in technologically precocious China.

But most important, the discussion sorely lacks a contemporary perspective, except for Bernadette Bensaude-Vincent's chapter on plastics and biomimetics. This debate is no historical curiosity, but urgently needs airing today. Legislation on trans-species embryology, reproductive technology, genome engineering and environmental protection is being drawn up, based on what sometimes seems to be little more than a handful of received wisdoms (some of them scriptural) moderated by conventional risk analysis. There is, with the possible exception of discussions on biodiversity, almost no conceptual framework to act as a support and guide.

All too often, what is considered 'natural' assumes an absurdly idealized view of nature that owes more to the delusions of Rousseau's romanticism than to any historically informed perspective. By revealing how sophisticated, and yet how transitory, the distinctions have been in the past, this book is an appealingly erudite invitation to begin the conversation. ■

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