

► Horns' recalls Rous's pioneering work on tumour viruses, before introducing Richard Shope's discovery of the rabbit papilloma viruses, to which the essay title refers. Harald zur Hausen and colleagues discovered human cervical papilloma viruses in 1983; the vaccines that target them to protect women against cervical cancer were licensed in 2006. Thus, 100 years of tumour virology paid off. Rous may have had to wait longer than any other Nobel laureate to win his prize in 1966, whereas zur Hausen's 'incubation period' was a mere 25 years.

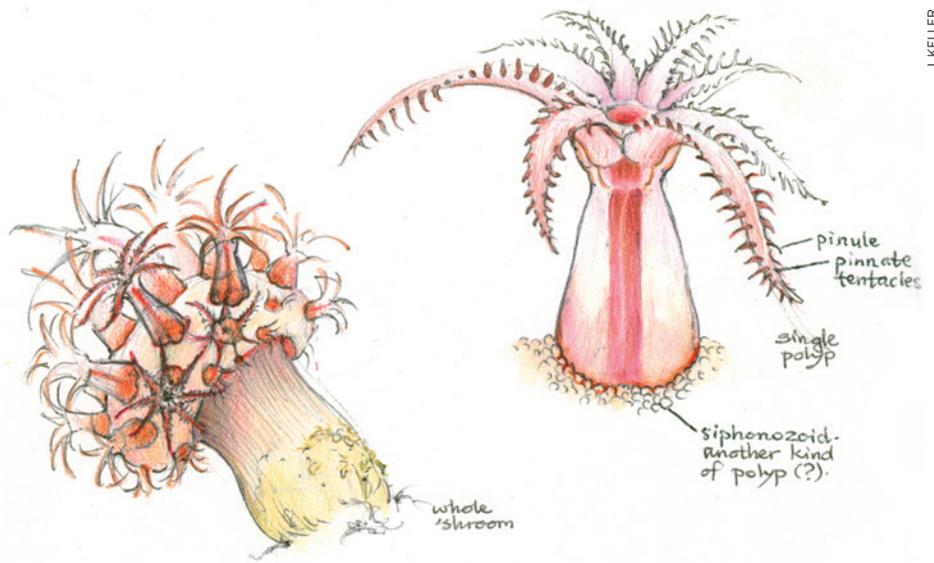
Owing to Zimmer's puzzling reluctance to delve into molecular virology, we have to wait until the end of the last and best essay, on the giant mimiviruses — discovered only in 1992 — to learn that some viruses have RNA genomes instead of DNA. No other replicating systems carry their genes in the form of RNA, as do polio, measles, influenza and most plant viruses. Some viruses have double-stranded RNA, whereas others are single-stranded; some viruses carry a single RNA or DNA molecule, and others have segmented genomes like the different chromosomes of higher organisms. Neither of the two chapters on retroviruses mentions reverse transcription — by which the RNA genome is turned into DNA before inserting itself into host DNA — even though the most potent anti-HIV drugs are designed to block this process.

Perhaps Zimmer thinks such facts are too difficult for his readership, but I view avoiding them as dumbing down. Which viruses evolved from bacteria, and which are more likely to have emerged as sets of genes that escaped from their hosts? Are some viruses relics from an RNA-based world, or are they relatively modern parasites derived from other living systems? Zimmer eventually raises the last question, but to my mind, the fascination of viruses is their enormous molecular and evolutionary diversity as much as their pervasiveness in the environment.

Concern for accuracy seems to have suffered as Zimmer becomes an ever more prolific writer. Some virologists' names are wrong, for instance, as are some other simple facts.

In a foreword to Peter Medawar's 1996 collection of essays, Stephen Jay Gould called this literary form "a weapon of wit and instruction". It would be difficult for any science writer to match Medawar or Gould; nevertheless, Zimmer's contributions fit this definition well. ■

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J. KELLER

A mushroom coral and one of its polyps drawn in the field by science illustrator Jenny Keller.

TECHNIQUES

Records in the field

Good notebook skills are vital for documenting observations of the natural world, finds **Sandra Knapp**.

Field biology: the very words conjure up romance, danger, excitement. There is a thrill to fieldwork that makes lab-based scientists ask "How was your holiday?" when one returns from a stint outside. Many books have been written about the explorers of the past, transcribing their logs and journals, or fictionalizing their adventures. This volume is refreshingly different. Biologist Michael Canfield has compiled a set of essays not on researchers' travels, but on how they capture their experiences in their notes.

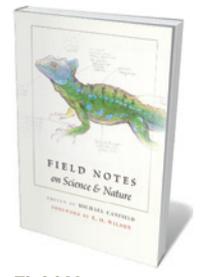
Field Notes on Science & Nature is an eclectic collection that crosses many disciplines, from geology, botany and zoology to art and anthropology. The variety of styles and records described are fascinating — field notes are very personal. Some of the contributors take notes entirely electronically, others in red pen in cheap notebooks. Others use pictures more than words.

Few of us have the artistic skills of Jonathan Kingdon or Jenny Keller, scientist-illustrators whose drawings alone make this book worth buying. But even the sketchiest sketch can call to mind a place or organism in a way no words can. I remember the field books of a friend with whom I worked in the tropical forests of Central America: an incredible mixture of description, sketches and taped-in leaves. Today, his

seemingly chaotic collections evoke those places far better than my own lists. I learned from this, and started to sketch the plants I collected — flower and leaf shapes, plant forms and outlines appeared in my pages.

The tradition has a long pedigree, encompassing notebook sketches by the great Victorian naturalists. My favourites are those of Henry Walter Bates, Alfred Russel Wallace and Richard Spruce, early evolutionists who mused on the page about why, as well as what and where. Keller's advocacy of standardized colour palettes in her essay harks back to the methods of eighteenth-century illustrator Sydney Parkinson, who accompanied Joseph Banks on Captain James Cook's voyage on HMS *Endeavour*, or the Austrian Bauer brothers, one of whom accompanied Captain Matthew Flinders on HMS *Investigator* a few decades later.

Parkinson drew and painted all of the plants that were collected, but for efficiency only coloured part of each (a practice recommended by Keller). He died on the voyage,



Field Notes on Science & Nature
EDITED BY MICHAEL R. CANFIELD
Harvard University Press: 2011. 320 pp.
\$27.95

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but his work was enough to enable the publication of the entire collection two centuries later as a series of coloured plates. Ferdinand Bauer's sketches of plants and animals of Australia were intricately labelled with numbers indicating colours; it was only in the twentieth century that the key to the colours was discovered, deep in the collections in Madrid. His brother, Franz, used the same key in botanical paintings he made at Kew, near London.

Accuracy and speed of capture of the image are just as important now. But digital photography has not obviated the need for field sketches. As many contributors point out, a sketch can be labelled on the spot and does not require printers, cameras and other electronic hardware to be carried to remote places.

Whether notes are telegraphic or detailed, a key to abbreviations is a must. Making field notes directly on the computer can solve the transcription problem, as one only has to enter information once and typed text is easy to read, say entomologist Piotr Naskrecki and plant biologist Jim Reveal. But, Reveal adds, computerized notes lack the personality so apparent in handwritten accounts.

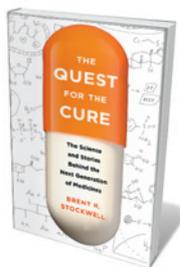
Illustrated field notes can provide the basis for public conversations on science. For example, anthropologist Karen Kramer's sketch maps of Mayan villages aided her research into how the villages functioned because local people were happy to talk about her interpretations of their space. And ornithologist Kenn Kaufman describes the species lists made through the eBird project, which records birders' observations via a website. This crowd-sourcing method of taking field notes is an extension of the 'bioblitz' concept, in which members of the public list all the species they encounter over a short period.

It is disturbing to observe, as ecologist Erick Greene does in his essay on best practice, that today's generation of field biologists do not keep notes as diligently as their laboratory-based counterparts. Lab books are retained as permanent records (sometimes drawn upon in cases of scientific misconduct), whereas field notebooks are rarely archived. Yet they record observations that might seem trivial at the time, but on reflection become the basis for new insight. As ecologist Bernd Heinrich rightly says, notes from the field often represent a search for problems, not solutions. Who knows whose field notebooks now contain observations that will change the world?

I will alter my own note-taking after reading this set of essays. All scientists, whether based in the field or the lab, could benefit from the advice given here so eloquently. ■

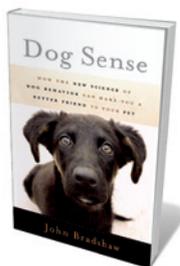
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Books in brief



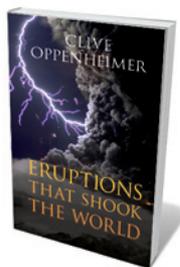
The Quest for the Cure: The Science and Stories Behind the Next Generation of Medicines

Brent R. Stockwell COLUMBIA UNIVERSITY PRESS 284 pp. \$27.95 (2011)
In the past 50 years, we have developed drugs to cure many major diseases. But treatments for some serious conditions, such as cancer and Alzheimer's, still elude us. Chemical biologist Brent Stockwell describes the history of drug design, from the invention of mustard gas and early anti-cancer agents to the decoding of the human genome. Countering the pessimists who fear that the end is nigh for significant breakthroughs, he argues that emerging technologies for drug testing and molecular modelling will open up new avenues.



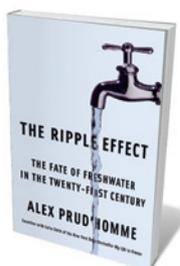
Dog Sense: How the New Science of Dog Behavior Can Make You a Better Friend to Your Pet

John Bradshaw BASIC BOOKS 352 pp. \$25.99 (2011)
Although dogs are loved by many, their lot is not always a happy one. Originally bred as rural working animals, most dogs now live in cities where they are expected to be more obedient than any child. The perpetuation of pedigrees also mars the health of some breeds. Anthrozoologist John Bradshaw summarizes what science can teach us about man's best friend. Arguing that modern dogs should not be considered domesticated wolves, he asks how we can best breed these social animals to be companions and family pets.



Eruptions that Shook the World

Clive Oppenheimer CAMBRIDGE UNIVERSITY PRESS 408 pp. £18.99 (2011)
Closures of international airspace after the recent Icelandic eruptions served as a reminder that volcanoes can be disruptive. But volcanic outbursts have also shaped our history, from aiding the demise of the dinosaurs to altering climate. Ash ejected into the atmosphere may even have led to the meagre harvest that triggered the French Revolution. Volcanologist Clive Oppenheimer relates in rigorous detail the consequences of eruptions over the past quarter of a billion years, and argues that lessons can be learned for future risk management of catastrophes.



The Ripple Effect: The Fate of Freshwater in the Twenty-First Century

Alex Prud'homme SCRIBNER 448 pp. \$27 (2011)
Flooding and drought are both on the rise. Journalist Alex Prud'homme digs into the reasons why, citing centuries of neglect of water infrastructure and a careless attitude to issues of water quality and use, ownership and waste. Focusing on issues that threaten clean and abundant water in the United States, he travels across the country to speak to people at the centre of the drama, including salmon fishermen and copper miners in Alaska and scientists investigating intersex fish in Chesapeake Bay.



The Fallacy of Fine-Tuning: Why the Universe is Not Designed For Us

Victor J. Stenger PROMETHEUS 345 pp. £24.95 (2011)
The Universe seems to be fine-tuned, with precisely set parameters that allow life to exist as a rare event. This idea has been used by some to argue that humans have a central place in the cosmos, and even as evidence for the existence of God. Physicist Victor Stenger rails against this 'fallacy' by dismantling such assumptions one by one. The laws of physics and cosmology constrain some key numbers, he says, and others are not as fine-tuned or as improbable as proponents of the idea suggest.